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MEDICINE.—*Aspects of epidemiology of tuberculosis.*[1]

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Despite the difficulty the American Public Health Association had a short time ago in settling upon a definition of an epidemiologist, I believe it is not impossible to say what epidemiology is. Epidemiology is the ecology of disease. It is the life history and environmental relationships of disease. It places less emphasis on how disease acts on the individual and more on its mass manifestations; little on symptoms, much on how it spreads and is influenced by all possible variant factors.

The study of tuberculosis is tremendously complex, and the results that have been obtained are confusing. This is not because the organism causing the disease is difficult to obtain and study. True *Mycobacterium tuberculosis* grows slowly, but we have long had satisfactory culture mediums and suitable experimental animals are readily available. There is, however, no disease concerning which there are more disputed concepts and theories. Shortly after the tubercle bacillus invades the body successfully the tissues take on a new and specific capacity to react. If into the skin of such a person a tiny bit of the soluble protein of the tubercle bacillus is injected, there is a decisive response. The area becomes inflamed, slightly raised, unusually firm, and somewhat painful. It is, in fact, a typical area of response in inflammation. This reaction reaches its height on the second and third day and thereafter slowly fades away. This is a positive tuberculin test. By contrast, a person who has not been successfully invaded by the tubercle bacillus will give no reaction to a similar injection or indeed to one many times stronger in its tuberculin content.

The condition of the individual that causes him to react to the injection of tuberculin is the "tuberculin type of hypersensitivity." It would seem simple to determine whether it is better to be tuberculin positive or tuberculin negative, but it is not. Is this tuberculin type of hypersensitivity the same thing as immunity? It is not easy to decide, and any answer given will be disputed. Woodruff and Kelly (1942) observed: "Before tuberculosis can be controlled successfully fundamental concepts concerning reactions of the host to the infectious agent must be clarified. Perhaps the most important of these concepts is the relation between the hypersensitive or allergic response and immunity." Shall we immunize our children against tuberculosis? We immunize them against diphtheria; why not against tuberculosis? In 1940, 60,428 persons died of tuberculosis in the United States and only 1,457 of diphtheria. It may be objected that tuberculosis is not a childhood disease. It is not, and it is much less so now than it was in 1900, but in 1940 a total of 2,787 children under 15 years of age died of tuberculosis, almost twice the total number dying of diphtheria.

When we have clinical tuberculosis where do we get it? Is it from within—the lighting up of an old arrested focus—or is it from without by contact, often repeated, with open cases of tuberculosis? We now favor the latter view, exogenous infection, but it has not been many years since the former view, endogenous infection, was our gospel. Years ago we used to speak of the childhood type of tuberculosis. Now we call

[1] Address of the Retiring President of the Washington Academy of Sciences delivered at the 324th meeting of the Academy on February 17, 1944. Received March 15, 1944.

it "first infection phase." In this form of infection the tubercle bacillus localizes in the outer parenchyma of the lower- or mid-lung field, and there is developed an area which, when it later becomes encapsulated, calcified, or perhaps even ossified, is known as a Ghon tubercle. Before this happens, however, the little colony of tubercle bacilli, often too small to be seen with the naked eye, establishes connection with functionally adjacent lymph nodes and there sets up a focus of tuberculous infection that in time usually becomes calcified and, if large enough, visible in X-ray plates. The tubercle and its involved lymph node form the Complex of Ranke. As a usual thing an individual harboring this pathology suffers, particularly if he is not a very young or a weakly person, few if any clinical symptoms. Some years ago it was believed that almost every child had such a "primary infection." Now it is known that most children escape any form of tuberculous infection and that "first infection phase" tuberculosis comes in both adults and children. Is it the same usually benign disease in adults that it used to be in children, or is it much more serious? We have a debatable proposition.

Years ago we used to speak also of the "adult" form of tuberculosis. Now we call it "reinfection phase" tuberculosis. This is tuberculosis developing in an individual who has had "first infection phase" tuberculosis and is thereby a different host from the individual never contacted successfully by the tubercle bacillus. In this form of disease the lesion usually appears in the upper third of the lung and does not involve the functionally connected lymph nodes. When such lesions heal they show less of calcification and more of resorption and fibrosis. Spread of this type of disease, which frequently occurs, is by caseation, liquefaction, and excavation. This "adult" type of disease can, of course, occur in a child provided it is an individual who has had "first infection phase" tuberculosis. It was formerly thought that such disease arose chiefly from one's own reservoir of tubercle bacilli held over from an arrested "first infection phase" attack. The fact that overwork, worry, undernourishment, and other untoward socio-economic factors predispose to tuberculosis fitted in very well with the idea that each man carried about his own potential tuberculosis and might light it up as an adult by lowering his personal resistance.

The following quotation from the American Review of Tuberculosis (1920) is not the point of view held today:

> In adults the problem of preventing infection requires very little attention. The great majority of adults have already been infected before reaching adult life. What adults have to fear most is not further infection from without, but an extension of the infection which they already have, leading to the development of a group of symptoms which we are pleased to call the disease tuberculosis. All adults should of course avoid prolonged and intimate contact with the grossly careless tuberculous person; but there is little to be feared through ordinary contact. It has been said that the careful consumptive is not a danger to anyone. This might be modified to read the consumptive is a grave menace to infants, less dangerous to children, and no danger at all to adults if reasonable care be exercised.
>
> Let me emphasize again. We should not be afraid of the tubercle bacillus. For ourselves, as adults, as a rule we need fear no attack except from those that are now in our bodies. For the children, since we cannot permanently protect them from invasion, let us wisely choose the time when the bacilli are first to be met. If this be done, the tubercle bacilli may be transformed from a menacing enemy into a protecting friend. This is what should be taught to every adult, as comprising the knowledge in accordance with which he should live and act as an individual.

Today we favor the view that tuberculosis may be contracted from continued contact with open cases and that its incidence may be reduced by eliminating sources of infection from milk or meat; by minimizing contact with open cases through early and accurate diagnosis and isolation; and by proper care of those having tuberculosis including full attention to proper nutrition and conditions of living. What a change of point of view within a generation! Some areas are even working on the hypothesis that all tuberculosis can be prevented. Certainly one can not develop tuberculosis without first becoming tuberculin positive. Hence, in certain parts of the country where conditions are favorable an effort is being made to place tuberculosis on the county accreditation basis. In 1940 the death rate

for tuberculosis in the continental United States was 45.9 per 100,000, one of the finest rates anywhere in the world. It is a reasonable estimate that in that year about 50 percent of our total population were tuberculin positive. Minnesota has established county accreditation for tuberculosis. This "new idea in human tuberculosis control" provides that a county shall be accredited in which there is an average annual death rate of 10 or less per 100,000 and a tuberculosis infection rate, as evidenced by a positive tuberculin test, of less than 15 percent among high-school seniors. At least seven of Minnesota's 97 counties have already qualified for this honor.

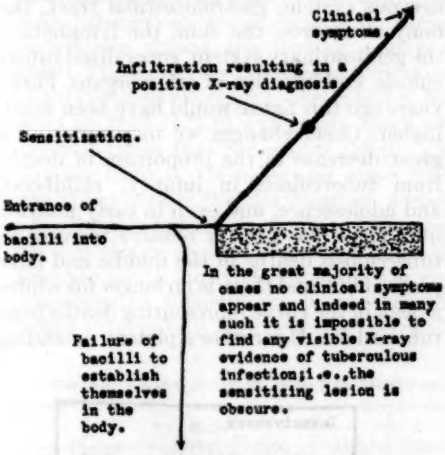
Clinical symptoms.
Infiltration resulting in a positive X-ray diagnosis.
Sensitization.
Entrance of bacilli into body.
In the great majority of cases no clinical symptoms appear and indeed in many such it is impossible to find any visible X-ray evidence of tuberculous infection; i.e., the sensitizing lesion is obscure.
Failure of bacilli to establish themselves in the body.

DIAGRAM I.—The result of the invasion of the body by tubercle bacilli.

Casual reference to tuberculous infection as something quite time extensive has probably been confusing to the reader. Reference to Diagram I should assist in the understanding of the early stages in the host-parasite relationship of the tubercle bacillus and man.

Some diseases are short lived and decisive. The patient is sick two or three days and then is about his work. Such a disease is a mild attack of influenza. In typhoid fever, on the other hand, the patient may be ill six weeks or more, and there is a further period of convalescence to add to the six weeks' loss of time from work. In tuberculosis there may be a very gradual onset involving two or three years before the patient has any symptoms at all. Probably every person in the United States has swallowed or inhaled at least one living tubercle bacillus even in this day of allegedly fine progress in the elimination of tuberculosis. In half, or more than half of us, the microbe did not successfully invade the body. (Some of the points involved in the host-parasite relationship bearing on this point are fascinating to contemplate but difficult to set in order, and they are graphically suggested in Diagram II.)

Shortly (two to seven weeks) after the tubercle bacillus has invaded the body the tissues become sensitized and the host is altered profoundly, just how profoundly we do not yet know. The elicitation of a positive tuberculin test from such a person is only one aspect of the matter. The sensitized individual possesses a new reaction pattern, which he will keep as long as viable tubercle bacilli remain in his body.

Fortunately, the great majority of sensitized individuals do not progress further toward clinical tuberculosis. Such individuals are harmless to others in their environment, for the tubercle bacilli causing the sensitization are locked within their bodies. Indeed, as Long has so well pointed out, the tuberculous individual does not enter into the epidemiological picture until his pathology is well advanced. Large lesions caseate, liquefy, and erode into bronchi where bacilli are spread farther within the lung of the hapless patient or expectorated to the outside world. Interestingly enough, the number of tubercle bacilli becomes very great in an area of just this type, whereas they might have been rather few in the same area a month earlier.

Only a few of those who become tuberculin positive for the first time will progress to the point where roentgenological evidence can be obtained that they are ill, and of these by no means all will advance farther to the point where clinical symptoms can be noted. Furthermore, if taken at the stage of minimal tuberculosis, the disease is easy to arrest. Even if arrested the individual will still, for a long time, likely for life, harbor some of the tubercle bacilli that

multiplied within his body. It may seem odd that one can be in good health and play host to pathogenic organisms. Such a healthy arrested case should not be a source of danger to others, but it is important to point out that every extensive survey of adults reveals some of these individuals who are not satisfactorily arrested cases and who continue to work or even attempt to enlist in the Army or Navy while really suffering from moderately advanced or even far advanced tuberculosis. Ironically, many of them are not even aware of the seriousness of their condition. The tubercle bacillus is not a vicious pathogen despite the fact that it causes the most important single disease from which man has ever suffered. It is therefore all the more important that the facts about tuberculosis be known, so that medical practice and science can continue adequately in the effort to solve the tuberculosis problem.

What is the present status of tuberculosis as a medical problem?

First of all, it is worthy of note that there has been a very marked decrease in this country in the number of deaths from tuberculosis. In 1900 the rate was 194.4 per 100,000; in 1940 it was 45.9; in 1942 it was 43.1. There was only 1 death in 1940 where there were 4.2 deaths in 1900. Not only has the number of deaths decreased but the distribution of those deaths has changed both within the total mortality picture and within the mosaic of tuberculosis itself. Table 1 will make some of these changes clear.

It will be noted that in 1900 tuberculosis accounted for 11.3 percent of all deaths. By 1940 this figure had fallen 2.6 times, to 4.2 percent. Another significant point not shown in the table is that the disease is becoming pulmonary in type. In 1940, of the 60,428 deaths from tuberculosis, 55,576 deaths were pulmonary tuberculosis. Just over 8 percent were tuberculosis of the central nervous system, gastrointestinal tract, the bony structures, the skin, the lymphatics, the genitourinary system, generalized tuberculosis, and infection of other organs. Forty years ago this figure would have been much higher. Other changes we may note are a great decrease in the proportion of deaths from tuberculosis in infancy, childhood, and adolescence, and even in early married life. There has been a relative increase in tuberculosis deaths in the middle and later years of life, and there is no longer for whites a peak in the curve representing deaths from tuberculosis. It is rather a plateau extending

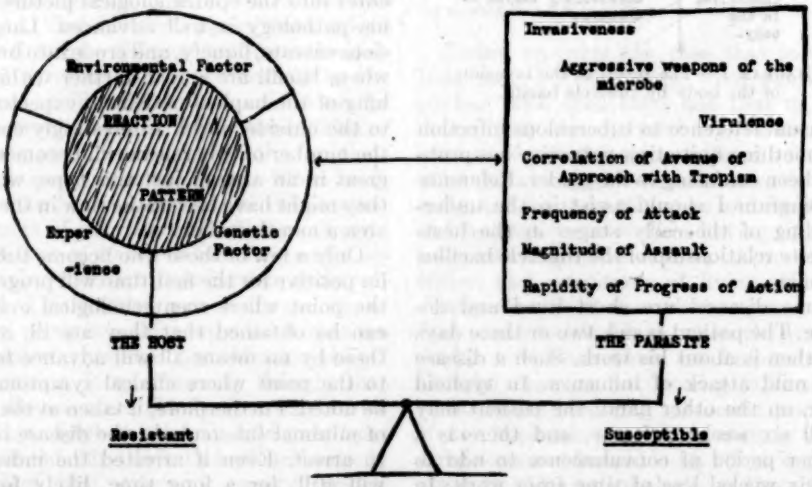

DIAGRAM II.—Some of the factors entering into the host-parasite relationship which have much to do in determining the outcome of an infection.

over three or four of the most important decades of life.

Tuberculosis mortality is much higher among males than among females. In the States Relations Division of the United States Public Health Service there is now a Tuberculosis Control Section headed by Dr. H. E. Hilleboe. Tuberculosis mortality in the United States, 1939–1941, was reviewed by three Public Health Service workers in Public Health Reports for October 1, 1943. They point out that for these three years, 1939–1941, the male death rate (53.6) was 41 percent higher than the female rate (38.1). This excess in mortality among males is higher for tuberculosis than that from deaths from all causes. For these three years tuberculosis was seventh in numerical importance among the leading causes of death. There are very large racial differences in tuberculosis mortality, the rate for Negroes in 1940 (123.5) was nearly three and one-half times that for whites (36.6). The rate for Indians, Chinese, and other races was about double that for Negroes. Among non-whites tuberculosis was third in numerical importance as a leading cause of death. Another point, hotly disputed in the epidemiology of tuberculosis, is whether the Negro tuberculosis experience is the result of the less favorable socio-economic conditions under which they live or is due to inherent biological racial differences between whites and Negroes.

Tuberculosis is still among the three leading causes of death for a relatively large portion of the life span (15–49 years of age). It holds first place at ages 15 to 34, second at 35 to 39, and third at 40 to 49. For males tuberculosis is among the first three leading causes of death at ages 15 to 54, and for females at ages 10 to 44. For whites only, it is among the first three leading causes of death at ages 15 to 49 for both sexes, ages 20 to 54 for males, and 15 to 44 for females.

Table 1 reveals the fact that though we have made worthwhile progress in the fight against tuberculosis this progress compares unfavorably with advances made in the control of such diseases as typhoid and diphtheria, and indeed for the whole group listed together in the table, viz., typhoid, malaria, measles, scarlet fever, whooping cough, and diphtheria. In 1900 tuberculosis caused only 1.7 times as many deaths as this arbitrarily selected group. In 1940 this figure became 7.1 by virtue of the more perfect control of the selected group of diseases. Significant, too, is the more marked diminution in the deaths that occur in chil-

TABLE 1.—CHANGE IN DEATH RATES (PER 100,000) FROM 1900 TO 1940 FOR TUBERCULOSIS AND SOME OTHER DISEASES

Disease	Ratio 1900/1940	1900	1905	1910	1915	1920	1925	1930	1935	1940
All deaths	1.59	1,719.1	1,588.9	1,468.0	1,317.6	1,298.9	1,168.1	1,132.1	1,094.5	1,076.4
Tuberculosis	4.2	194.4	179.9	153.8	140.1	113.1	84.8	71.1	55.1	45.9
Percent of all	2.6	11.3	11.3	10.4	10.6	8.7	7.2	6.2	5.0	4.2
Typhoid	31.3	31.3	22.4	22.5	11.8	7.6	7.8	4.7	2.7	1.0
Malaria	5.6	6.2	2.5	1.1	1.6	3.4	2.0	2.9	3.5	1.1
Measles	26.6	13.3	7.4	12.4	5.2	8.8	2.3	3.2	3.1	0.5
Scarlet fever	19.2	9.6	6.8	11.4	3.6	4.6	2.7	1.9	2.1	0.5
Whooping cough	5.5	12.2	8.9	11.6	8.2	12.5	6.7	4.8	3.7	2.2
Diphtheria	36.6	40.3	23.5	21.1	15.2	15.3	7.8	4.9	3.1	1.1
Totals	17.6	112.9	71.5	80.1	45.6	52.2	29.3	22.4	18.2	6.4
Diarrhea in babies (−2)	15.2	115.9	98.4	98.4	55.7	43.4	30.8	19.4	10.4	7.6

Data from the Bureau of the Census, based on the expanding Registration Area. Since 1933 this area includes all continental United States.

The rate for tuberculosis was 4.2 times as high in 1900 as it was in 1940. This is for all ages. The change has not been the same for all age groups:

Under 1 year	12.6	25–34 years	5.2	65–74 years	3.1
1– 4 years	8.2	35–44 years	4.2	75–84 years	3.4
5–14 years	6.5	45–54 years	3.2	85 years and up	3.2
15–24 years	5.3	55–64 years	2.9		

dren under two years of age from diarrhea and enteritis. That improvement in the tuberculosis picture has occurred is, of course, true. Our chances of dying of tuberculosis are now computed at quite a more favorable level. It is also of interest to note that the percentage of persons tuberculin positive has been falling. For instance, one of the earliest reports on the results of tuberculin testing of a student group was based on a study conducted at the University of Minnesota in 1928. Thirty-one percent of 2,000 students were found to be tuberculin positive. In 1941–1942 only 17 percent of 5,481 students were positive. Thus in 13 years there was a reduction of 45 percent in the number of tuberculin reactors. Similar information gathered from school surveys all over the country is much more significant than may on first thought occur to one. We are fast becoming a nation of unsensitized individuals with respect to tuberculosis. There has long been a considerable school that has maintained that sensitization in the sense of tubercularization without progression is protection. What, they ask, will be the outcome as more and more tuberculin negative children become adults and first meet the tubercle bacillus under war-time and reconstruction conditions? It is possible that the medical-school tuberculosis problem may cast light upon this matter, but before that point can be presented it is logical to consider the effect of war on tuberculosis morbidity and mortality.

What was the effect on the tuberculosis rate of World War I? Dr. Long describes the situation in Europe by observing: "After years of continuous drop, the rate began rising in 1915 and by 1918 had reached a figure in all countries about 25 percent higher than at the beginning of the war." Wolff has described the privations of the period as "an involuntary mass experiment . . . of more epidemiological importance than endless theorizing on the pathology of tuberculosis." These statements may be amplified in the words of an August, 1941, article in the Statistical Bulletin of the Metropolitan Life Insurance Co., in part as follows:

The experience of the World War of 1914–1918 affords an indication of what is likely to occur. None of the belligerent countries escaped an increase in tuberculosis then, and practically all of the neutral countries of Europe suffered either an increase in tuberculosis or a slowing up of the prewar rate of decline. The most reliable data for the period relate to the trends among women and children in England and Germany. Among English women the mortality from pulmonary tuberculosis rose steadily during the war to a peak in 1918, when it was over 25 percent higher than in 1913. Among German women the pulmonary tuberculosis death rate rose slowly at first, but after 1916 the increase was very rapid, so that by 1918 the rate was nearly 75 percent above that of 1913. Indeed, in Germany the death rate from tuberculosis among women did not return to the prewar level until 1921; and this improvement was not maintained for a few years following. The rate of increase among German females was greatest at ages under 20 years. Among children the rate in 1919 was even higher than during the war.

Far worse was the situation among the other belligerent countries of the Continent, but only fragmentary statistical data are available to show the frightful increases in some of these areas. The statistics of tuberculosis mortality in France during the war are defective because of the absence of facts for the invaded regions, where the situation was at its worst. The data for the uninvaded portion show a sharp increase, particularly in 1917 and 1918. In the latter year the recorded rate was about 20 percent higher than in 1914. The accuracy of these statistics is doubtful, and the actual increase was probably larger. To some extent the same observation probably holds for Italy, but in that country even the recorded deaths from tuberculosis in 1918 were over 40 percent in excess of the 1914 rate.

A few examples will show the extremely bad conditions in Belgium and in eastern and southeastern Europe. In Brussels the death rate from tuberculosis doubled during the war, from 177 per 100,000 in 1914 to 390 in 1918. In Vienna the rate in the period 1915–1918 was 20 percent higher than in 1911–1914, and in the early postwar years it increased to 50 percent above the prewar rate. In Budapest the number of deaths from the disease in 1917 was nearly double that of 1913, and it was but little less in 1918. In Warsaw the rate in 1917 was 840 per 100,000, as compared with 306 in 1913; in Cracow during the same period the rate increased from 487 to 908 per 100,000. In Belgrade the tuberculosis death rate in 1918 reached the almost incredible figure of 1,400 per 100,000.

Typical of the trend of tuberculosis in the neutral countries of Europe during the World War are the experiences of the Netherlands and Switzerland. In the former, the death rate from the disease rose steadily, until in 1918 it was nearly 50 percent above the 1914 figure. In

Switzerland, where the trend was sharply downward before the war, the rate continued to fall at first, but rose in the latter part of the war to a peak of 207 per 100,000 in 1917, or 6 percent above the rate in 1914.

In our own country the mortality from tuberculosis showed little change during the World War period as a whole, but even here there was a slight increase in the death rate during the period of our active participation in the war. Thus the death rate in the original Registration States declined from 148.6 per 100,000 in 1914 to 143.8 in 1916, but then rose to 147.1 in 1917 and further to 151.0 in 1918."

These increases come about through breakdown in resistance to disease on the part of the host, to increase in opportunities for infection, and to a decrease in or, indeed, collapse of facilities available for proper recognition, isolation and treatment of disease. Specifically some of the factors for tuberculosis are:

1. The entrance of women into heavy and fatiguing industry.
2. The return of the older age groups to active employment.
3. The return to work of persons of either sex or any age physically unfit to work.
4. Long hours of work often emotionally compensated for by long hours of strenuous or injudicious relaxation—"burning the candle at both ends."
5. Relocation in areas of intense war industry activity resulting in congested living conditions without adequate sanitary facilities.
6. Relocation in areas of intense war industry activity where tuberculosis rates may be high by persons coming from areas where tuberculosis rates are low.
7. Congestion in concentration camps, war prisoners' camps, evacuation depots or camps, and air-raid shelters.
8. Use of hospital beds formerly allocated to the tuberculous for more urgent war needs or actual destruction of hospital facilities by the bombings or bombardments of "total" warfare.
9. Loss of trained personnel to the war need —physicians, nurses, attendants, laboratory workers, and social workers—all needed to care for an increasing load of tuberculosis patients.
10. Food shortages, both qualitative and quantitative.
11. Impossibility for perfect rest conditions so necessary for the tuberculous and the pretuberculous.
12. Worry and anxiety over the fate of one's relatives or even of one's country.

One of these points deserves particular emphasis as far as this country is concerned. As pointed out in an editorial in the New England Journal of Medicine for January 27, 1944, "it is estimated that 25,000 had been diagnosed (*at induction*) to have a disease that neither they nor their friends would have suspected under prewar conditions. And how are these patients, many of whom need sanatorium treatment, going to be accommodated by the currently restricted personnel of the sanatoriums?" Early in 1942 the number of beds for tuberculosis patients in this country totaled 97,726, or 1.62 per annual death, which is at best well below the minimum standard set at 2 beds per annual death and far below the more ideal standard of 3. In 1942 only seven states and the District of Columbia had met the minimum standard. It is quite possible that under present conditions of personnel shortage the paper figure of 97,726 beds available for tuberculosis patients must be considerably discounted. Where fighting is actually going on the condition is, of course, much worse.

Just what has happened thus far in the present war? Hilleboe states that by the last half of 1942 in the United States the Bureau of the Census, by a sampling process, had sensed an increase in tuberculosis in the "critical areas," although the total figure for 1942 represents an all-time low rate of 43.1 per 100,000. In England he notes a 13 percent increase in deaths from all forms of tuberculosis in 1941 as against 1938. This represents more than 3,000 additional deaths each year from a preventable disease. Recently in the British Medical Journal (January 8, 1944) it is stated that in Belgium the registered cases of tuberculosis increased from 69,079 in December, 1941, to 109,511 in February, 1943, an increase in rate from the high figure of 830 per 100,000 to the startling figure of 1,330 per 100,000. If there are 10 clinical cases of tuberculosis for every annual death

we have in the United States less than 600,000 cases at the present time or only six times as many as now exist in little Belgium, which has perhaps only one-twentieth of our population. Many of our people are in, or shortly will be in, these unfortunate European countries. It would seem a safe prophecy to venture that the tuberculosis rate in this country may be slightly increased for a short period, but it should within a very few years again resume its downward trend.

In view of the very low rate now obtaining (43.1 in 1942) it would be reasonable to expect a greater setback relatively than we experienced at the end of World War I. The magnitude of this setback may not be so much one of significantly increased rate as of slowness to get under way again on the downward trend. For a disease as widely seeded in our population as tuberculosis and for a population more completely involved in abnormal war activity than was the case in World War I, it would not be surprising if this were to be so and the very favorable rates now attained would seem to be advanced posts we may have to abandon for some time. One factor in this slightly pessimistic prediction is our closeness to and commerce with the rest of the world in many parts of which tuberculosis is rampant.

At one time the hope was expressed that we might be able to eradicate tuberculosis by a given date—say 1960. It should be understood that any such statement was merely a slogan, a cry behind which to rally the forces fighting the great white plague. As Frost ably pointed out in one of his last papers, entitled "How Much Control of Tuberculosis?" it "is not necessary that transmission be immediately and completely prevented. It is necessary only that the rate of transmission be held permanently below the level at which a given number of infection spreading (i.e., open) cases succeed in establishing an equivalent number to carry on the succession. If, in successive periods of time, the number of infectious hosts is continuously reduced, the end result of this diminishing ratio, if continued long enough, must be the extermination of the tubercle bacillus." I am not aware that Frost ever set any date for this millennium. As a very humble student of epidemiology I am sure I can not. I doubt though if under present war conditions we have any reason to anticipate any lowering of the death rate for the entire country from 43.1 to even 10 per 100,000 for several decades. Many millions of Americans are already tuberculin positive; thousands of unrecognized advanced cases of tuberculosis exist today; Europe and indeed most of the rest of the world is heavily tubercularized. It is too much to expect tuberculosis death rates to continue to drop as rapidly as they have in the past. To reduce 194.4 by 10 percent is not so difficult as to reduce 43.1 by 10 percent.

One other point that Frost makes deserves our attention. He states: "It is highly probable that the cyclic changes in prevalence which are observed in some diseases are brought about chiefly by evolutionary changes in the characteristics of the specific microorganisms, the causes of which are to be found in uncontrolled natural forces." Frost mentions scarlet fever and diphtheria as two of the diseases that within the past 100 years have greatly changed, although in the case of diphtheria the change reversed itself and diphtheria is again a problem of some significance in parts of the world. Smallpox, since the Spanish American War, has been relatively mild when it has occurred in this country and in 1942 caused but two deaths. It could be possible that cyclic changes may be taking place in the nature of the tubercle bacillus making it less invasive, but whether this is so, how long it will continue, or whether it will reverse are propositions very difficult of proof. Again, case-finding among medical students and physicians yields results with suggestive implications for this point.

Case-finding means looking for cases of a given disease. It is done to discover unrecognized cases that should be brought under treatment for their own good and isolated or educated so that the public health may be protected by removing active sources of infection. Although useful for several diseases such as malaria and hookworm, even syphilis, case-finding is particularly adapted to tuberculosis. It is possible through tuber-

culin testing to discover those belonging to the tuberculin positive group of persons who can have tuberculosis and, by X-ray examination, to detect which of these have physical signs almost certain before long to produce clinical symptoms. Such individuals may be satisfactorily arrested with a minimum of treatment and loss of time whereas if the minimal case is not discovered in its incipiency a moderately advanced or even a far advanced case may result which is difficult or impossible to arrest. The great advantage to the careful examination of the would-be soldier or sailor is that tuberculosis is discovered, as never before, in the stage in which it is possible to do something about the matter. From the first approximately 400,000 men appearing for the Canadian Army, 1 percent were rejected for tuberculosis. Of 3,530 of these rejectees, there were 1,970 minimal tuberculosis, 1,298 moderately advanced cases, and 262 far advanced cases. This ratio of the different clinical types (and the same is true for all other large scale screenings) is the exact reverse of what occurs when we let nature take its course. In the past, minimal cases have been a minority in the treatment program with moderately advanced and far advanced cases constituting the great majority of cases coming to the attention of the physician and the care of his sanatorium. It is to be hoped that although we are at war care will be taken that the young men and women found to have tuberculosis will be adequately cared for.

Tuberculin testing is time consuming and costly and, I regret to say, is sometimes omitted from the case-finding set up. Celluloid films, 14 by 17 inches, are also very expensive, and several substitutes have been worked out making it possible to examine the lungs of all members of a group (a good case-finding team can do 500 persons a day) at a reasonable cost. While this expedient works and is therefore justified, from the epidemiological point of view it is distinctly faulty because the tuberculin test gives information we must have for the proper understanding of the disease, and the large plate provides a permanent record unequaled by most of the less costly substitutes. At George Washington University Medical School, through the interest and cooperation of the dean, a proper and complete case-finding program has been in progress almost five years. The organization and operation of this program are graphically indicated in Diagram III.

It will be seen from Diagram III that five different agencies must be integrated in the program. These are the tuberculin-testing group, the X-ray group, the chest physician group, the laboratory group, and the sanatorium group. Coordination is best effected by that agency having most student contact, which in our institution is the tuberculin-testing agency represented by the writer. When there is sufficient interest in the program on the part of the coordinator the cooperation of the other agencies is easily obtained and cheerfully given. In addition to the value of such a program to the health of the student body the tuberculosis case-finding program is an admirable laboratory experiment in preventive medicine.

When it was realized that exposure to open cases of tuberculosis had to be considered as an important factor in the etiology of the disease it was only natural that thought turned to medical personnel—physicians, nurses, hospital attendants, and students of medicine and nursing—as persons having an industrial hazard with respect to tuberculosis. Three examples will illustrate the validity of this assumption. Diehl and Myers reported in 1940 that at Minnesota it had been possible to check effectively on the careers of 1,673 of 1,894 medical students graduating from 1919 to 1936. Among these there were 107 cases of tuberculosis, 5 occurring before college, and 47 after college. It was found that 46 deaths had occurred among the 1,673, of which 11 had been from tuberculosis.

Again it is well known that inmates of our mental hospitals form a group among whom tuberculosis is especially important. A recent study of such individuals in New York revealed that on the average tuberculosis deaths in such groups in this state were relatively 12 times more numerous than for the state as a whole. In certain such institutions in this country where careful case-finding programs have been carried out on the attendants rates of infection and actual evi-

dence of disease, much higher than occurs for other individuals in the same area have been found.

Thirdly, the early experience at the University of Pennsylvania revealed the significance in that institution of tuberculosis for medical students. Less than 10 years ago among 514 Pennsylvania students 5.8 percent of significant tuberculosis was found. Happily, results in most other schools are much better, and in fairness to Pennsylvania it should be pointed out that subsequent studies there have revealed a very much lower rate. Nevertheless, there seemed to be much logic to the statement made in 1930 by Stiedl of Trudeau when he said: "Tuberculosis might be called an industrial hazard for the medical profession. It is the most important chronic disabling disease for the medical student, the young physician and the nurse."

In 1939 a case-finding program at George Washington University School of Medicine was instituted. For many years prior to this, as I shall show presently, we had been making tuberculin surveys of all students, but a complete case-finding program had not, prior to 1939, been in existence in our institution. It is greatly to the credit of my former colleague, Dr. John H. Hanks, now in the Philippines, and Dr. David James, then president of the Junior Class, that they furnished much of the initial enthusiasm needed to get the program under way. The interest from the first of Dean Walter A. Bloedorn and the whole-hearted cooperation of the roentgenological and chest physician group insured the success of the project. We have already indicated in a diagram how tuberculosis case-finding works. It remains merely to give some of the results and to make a few observations.

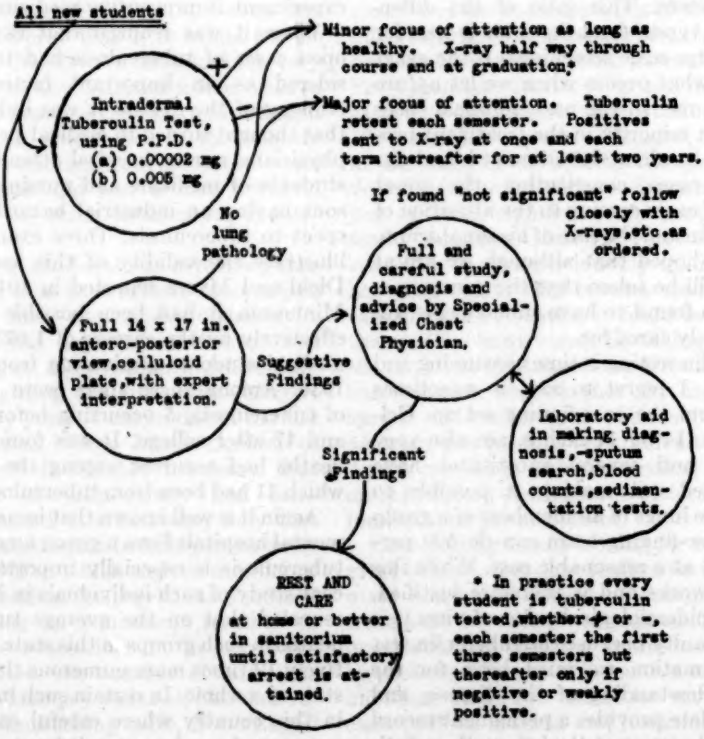
All new students
Intradermal Tuberculin Test, using P.P.D. (a) 0.00002 mg (b) 0.005 mg
+
−
Minor focus of attention as long as healthy. X-ray half way through course and at graduation.*
Major focus of attention. Tuberculin retest each semester. Positives sent to X-ray at once and each term thereafter for at least two years.
No lung pathology
If found "not significant" follow closely with X-rays, etc. as ordered.
Full and careful study, diagnosis and advice by Specialized Chest Physician.
Full 14 x 17 in. antero-posterior view, celluloid plate, with expert interpretation.
Suggestive Findings
Laboratory aid in making diagnosis, -sputum search, blood counts, sedimentation tests.
Significant Findings
REST AND CARE at home or better in sanitorium until satisfactory arrest is attained.
* In practice every student is tuberculin tested, whether + or −, each semester the first three semesters but thereafter only if negative or weakly positive.

DIAGRAM III.—Tuberculosis case-finding program at the School of Medicine, George Washington University.

The percentage of tuberculin positive reactors among fourteen consecutive classes totaling 1,007 students at George Washington University School of Medicine is shown in Table 2. With so many tuberculin negative students in school, a situation true in most other schools also, it was only natural to expect that many of them would become tuberculin positive. A good many of these tuberculin negative students did become tuberculin positive but not nearly so many of them as one might expect. Washington is in an area of high tuberculosis mortality (1940 figures, entire U.S.A., 45.9 per 100,000 population, District of Columbia, 64.4; Maryland 79.1; Virginia, 58.1), and our students certainly come into contact with tubercle bacilli. We were particularly impressed by the large number of those who were originally tuberculin negative and who remained negative through a complete medical education in Washington, D. C. Data on this point are presented in Table 3.

TABLE 2.—TUBERCULIN TESTS ON 14 CONSECUTIVE MEDICAL CLASSES AT THE GEORGE WASHINGTON UNIVERSITY

Class	Status	Number	Percent positive
1936	Sophomore	62	82.2
1936	Freshman	71	98.5
1937	Freshman	69	78.2
1938	Freshman	74	54.0
1939	Freshman	65	55.3
1940	Freshman	64	60.9
1941	Freshman	69	69.5
"1942"*	Freshman	71	42.2
"1943"	Freshman	74	44.6
"1944"	Freshman	65	46.1
"1945"	Freshman	78	34.6
"1946"	Freshman	77	40.2
"1947"	Freshman	83	53.0
"1948"	Freshman	85	43.5

* This school has been on the accelerated plan since before Pearl Harbor; the entering classes no longer require 4 years for graduation.

TABLE 3.—TRACING MEDICAL STUDENTS, ORIGINALLY TUBERCULIN NEGATIVE

Class	Total number of students tuberculin negative as Freshmen	Num- of these who left school	Number who completed all 4 years	Of these, number graduating tuberculin negative	Percent
Graduating Nov. 1943	35	5	30	22	73
Graduating Feb. 1943	42	6	36	21	58
Graduating 1942	40	3	37	23	62
Graduating 1941	21	5	16	7	44
Graduating 1940	24	6	18	13	72
Graduating 1939	30	6	24	11	46
Totals	192	31	161	97	60.

Of the 64 students, originally tuberculin negative, who became tuberculin positive, *four* developed clinical tuberculosis—one man losing two years, one losing one year, and two no time loss. All four at present are in fine physical condition.

We were further impressed by the fact that a considerable number of medical students who gave weakly positive tuberculin tests later became negative. Students were not followed prior to 1939 through all semesters; hence the figures on this point do not include all our approximately 1,000 students. Of those followed (666), however, 134 have reacted only to the strong dose of Purified Protein Derivative. This represents a low grade of sensitivity due perhaps to an almost negligible original sensitizing lesion or to a lesion almost completely sterilized or possibly, in an occasional case, to a nonspecific reaction. Nine classes are included in this aspect of the study, four of which are still in school, on whom obviously the data are not yet complete. In the five classes concerned that have graduated 56 showed weakly positive reactions as Freshmen. Of these, 18 showed stronger reactions as they progressed through school, indicating some sort of sensitizing or immunizing process at work. Six became entirely negative and one became weaker in tuberculin reactivity, 22 remained the same, and a few of the original Freshmen did not graduate. Among the 666 students of these nine classes 319 were positive to some strength of tuberculin as Freshmen (47.9 percent). Of these, 134 (42.0 percent) were weak reactors. Among the 323 students of the last four classes there were 139 reacting to tuberculin (43.0 per cent), of whom 78 were only weakly positive (56.1 percent). Among the 343 students in this series who have graduated there were 180 tuberculin reactors (52.4

percent), but of these only 56 were weak reactors (31.1 percent).

Several points may be made regarding these data. An environment containing tubercle bacilli does not prevent a certain number of weakly positive tuberculin reactors from becoming negative. These individuals may be thought of as resistant strains of the human race. Our newer students are showing not only a lower total tubercularization rate but also a tubercularization of less intensity. Tubercle bacilli in the environment are doing less to medical students than formerly. This is susceptible to three interpretations. The tubercle bacilli in the environment are becoming fewer; they are losing invasiveness and virulence; or, thirdly, the resistance of the young white American to tuberculosis is increasing. The first point is obvious but can hardly be the whole explanation. I believe we miss the full significance of the data if we do not also allocate some importance to each of the other two explanations.

Weight is added to this suggestion when we consider that the total number of tuberculin negative students in the school, all presumably susceptible to successful invasion by the tubercle bacillus, is increasing. This number is the census made up each semester after the tests are done. In November, 1941, there were 147 tuberculin-negative students in the school. In June, 1942, this number was 157. In November, 1943, it was 166 among 313 students, or a student body only 46.9 percent tuberculin positive. There has been a slight increase in the total number of students in the school, but this has been balanced off by the fact that our last two classes, though the initial tuberculin positive rate was low, had higher percentages than the average of the preceding four classes (48.3 as against 41.3 percent). Furthermore, since this program was started in 1939, only nine students have been found with minimal tuberculosis, although three others were detected shortly following graduation. At the present time, with 313 students in attendance, not one has minimal tuberculosis. This fine record surpasses that revealed in almost any mass survey of adults. Among 28,098 U. S. Government employees recently surveyed, 1.1 percent had recognizable tuberculosis (60.7 percent minimal; 35.3 percent moderately advanced; 4.0 percent far advanced).

It has been our purpose in presenting these observations to emphasize that although remarkable progress has been made in combating tuberculosis that progress has not equaled advance achieved in controlling other well-known diseases. We must believe that tuberculosis is still a major problem. Its eradication may be set back by the war but not irrevocably. Tuberculosis morbidity and mortality can be reduced to a satisfactorily low level, but I do not expect to see in my lifetime the absolute elimination of the disease. Our evidence suggests that the tuberculosis problem is not at present unduly significant for medical students and that there is some ground for considering either that the young white adult has more resistance to the tubercle bacillus than his father possessed or that the *Mycobacterium tuberculosis* is losing some of its virulence. Possibly a little of both is true.

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ETHNOLOGY.—*Algonkian ethnohistory of the Carolina Sound.*[1] MAURICE A. MOOK, American University. (Communicated by WILLIAM N. FENTON.)

SOURCES

During the period of first white contacts the Indian tribes inhabiting the area of the present State of North Carolina were of three linguistic stocks—the Iroquoian, Siouan, and Algonkian. The first two groups have been made the objects of investigation by both historians and anthropologists, but the Algonkian have been neglected and are still commonly called, as for example by Kroeber, the "little known" inhabitants of the Carolina Sound. Even the names and identities of some of the tribes are still in doubt—a situation due partly to the lack of primary historical sources relating to the groups in question and partly to students' failure to exploit thoroughly such sources as are readily available. The sources are few enough, and they are not particularly rewarding ethnologically. It seems time, however, to attempt an ethnohistorical picture of the area such as we already have for the neighboring native areas of the state (1).[2]

The Algonkian-speaking tribes of eastern North Carolina represent the southernmost extension of the groups of this linguistic relation which inhabited the Eastern States. All the tribes of New England were Algonkian in speech, those of the eastern portions of the Middle Atlantic states were of the same linguistic family, and the inhabitants of the tidewater area from the Potomac to the Neuse River were similarly affiliated (2). The classification is entirely linguistic, rather than racial or cultural, and is the only one available in the light of present information. The English were not so interested in native peoples as were the French or even the Spanish, and the historic ethnology of areas of English colonization is proportionately inferior. However, scattered native words in the relations of the Roanoke adventurers, modern place names of Indian derivation in the area, and the short Pamlico vocabulary given by Lawson in his *History* (3) are sufficient to justify the classification of the eastern native Carolinians as indisputably Algonkian.

The delimitation of the area of aboriginal Algonkian occupancy in Carolina is complicated by the fact that it was not coterminous with natural geographical lines of division, as was the case in Virginia. The Algonkian tribes of the Powhatan Confederacy in Virginia inhabited the tidewater area, with the fall line of the tidal rivers marking the western limit of Algonkian tribal distribution. In Carolina, however, tribes of Iroquoian and of Siouan speech also occupied the coastal plain. These latter groups were the western and southern neighbors of the Algonkian, with the latter inhabiting the region east of a line drawn from Bogue Inlet due north to the intersection of Meherrin River and the Virginia–Carolina line. Algonkian peoples thus occupied the greater portion of the area now contained in the 17 easternmost counties of the State, including most of the offshore islands. Algonkian occupancy covered some 6,000 square miles, approximately one-sixth of the land area of the modern State. The limits of distribution are tentative, however, for the western Algonkian boundary is merely suggested by contemporary accounts.

Our knowledge of the Carolina Algonkian of the late sixteenth century is derived

[1] Received February 28, 1944.

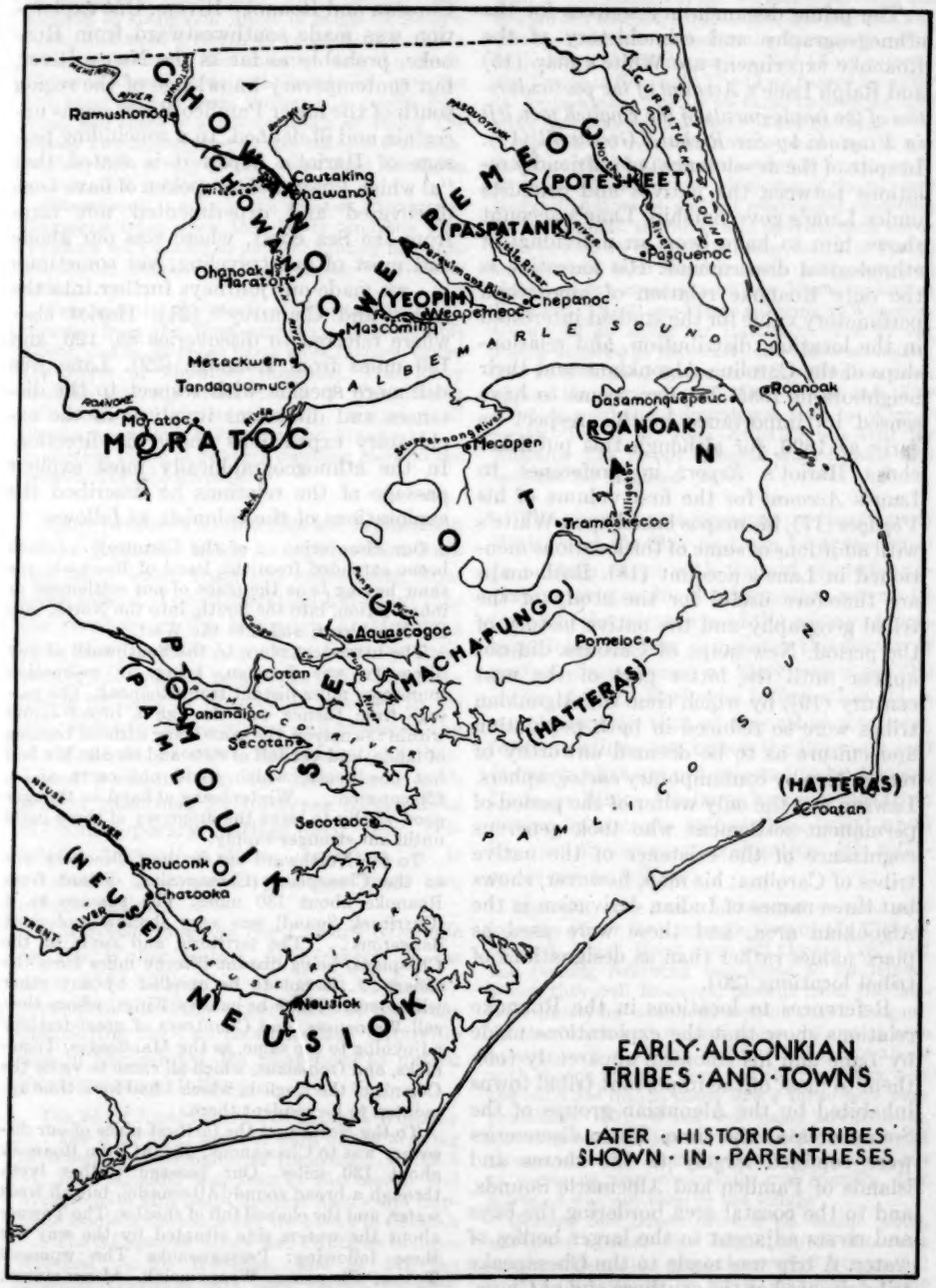
[2] Numbers in parentheses refer to the "Notes" at the end of the paper.

entirely from the documents of Raleigh's Roanoke enterprise. Historical research has added little of ethnological significance to the relations published by Hakluyt in 1590. It is now possible, however, to interpret these with less ethnohistorical naïveté than was characteristic of the days of Hawks, Hale, and Tarbox (4). Also for the problem of reconstructing tribal geography at the time of contact students now have access to facsimiles of John White's original maps of the Carolina coast (5). Until the publication of these facsimiles it was generally assumed that the engravings published by De Bry were faithful reproductions of the John White drawings. The De Bry engravings however, are now shown to be embellishments of White's original maps and other ethnological pictures (6). It has been said that "De Bry's engravings were copied, plagiarized, redrawn and re-interpreted for generations after his time" and that "De Bry is the man who immortalized the pictures (and maps) of the Roanoke colony" (7). This is historically correct, but it is also true that De Bry himself "copied, redrew, and re-interpreted" and that his pictures "immortalized" elaborations of the John White originals, rather than the originals themselves. Students of history and ethnology will prefer the originals in accurate facsimile (8). These are particularly valuable, for they are the first pictorial record of Algonkian environment and culture in the New World. Other than by the use of archeological methods it is impossible to come nearer to the aboriginal situation of precontact times in this area than by study of White's drawings and the written records of 1585–1590.

The written materials of the Roanoke colony are exceedingly uneven as sources of aboriginal history. Hariot's *Report* (9) is usually considered the classic in this respect, but it is disappointing as a document for ethnological and historical reconstruction. Unfortunately, Hariot's "Chronicle, according to the course of times," which in his *Briefe Report* he stated he had written and was holding for a "convenient" time for publication, apparently never was printed, or, if it was, it is now among the missing documents of the history of Roanoke settlement. From the point of view of historical anthropology this is a particular misfortune, for Hariot tells us that the Chronicle was a "large discourse . . . of the naturall inhabitants" (10).

Whereas Hariot's *Report* is quite silent on matters of tribal identity, location, history, and intertribal relationships, its section on "the nature and maners of the people" is historical in the sense that it describes aspects of the native culture at the time of contact. It is a gross exaggeration, however, to speak of it as "a statistical survey on a large scale" (11). Both historically and ethnologically it is less informing than Barlow's *The first voyage made to the coasts of America* (12). The value of the Barlow relation, on the other hand, is somewhat reduced by the fact that the first voyage was one merely of preliminary exploration, by an expedition too small in size and too short in duration to make more than superficial surveys of a small portion of the coast. Relationships with the natives were friendly, and Barlow was successful in obtaining considerable information during the few weeks he was in the Algonkian area. His tract was a report to Raleigh that presented a more hopeful picture of colonizing prospects than the resources of the region deserved, but there is little to indicate that his descriptions of native life are characterized by mistakes other than those that were the natural result of misunderstanding due to hasty and untrained observation.

White's relations of the fourth and fifth voyages made to Roanoke in 1587 and 1590 (13) are journals of the voyages, rather than accounts of experiences in the Carolina area. As such they are of little value as sources for the study of native history. Their almost complete lack of ethnological consciousness is sufficient, in fact, to suggest that John White the governor and the author of the relations may have been a different person than John White the artist of Lane's colony and the author of the map of 1585 (14). The map, with its long list of native locations, and the drawings of Indian scenes and subjects reveal an awareness of the native inhabitants that seems entirely foreign to the relations of the last two voyages.


CHOWANOC
(CHOWANOKE)
Ramushonoge
Cautaking
Chawanok
Ohanoak
Harato
Mascoming
Metackwem
Tandaquomuc
Maratoc
MORATOC
SEPEMEOC
(POTESHEET)
(PASPATANK)
Pasquenoc
(YEOPIM)
Chepanoc
Weapemeoc
ALBEMARLE SOUND
Dasamonquepeuc
Roanoak
(ROANOAK)
Mecopen
Tramaskecoc
CROATAN
Aquascogoc
(MACHAPUNGO)
Pomeloc
(HATTERAS)
Croatan
PAMLICO SOUND
POMOCK
(PAMLICO)
Cotan
Panandioc
Secotan
Secotaoc
NEUSIOK
(NEUSE)
Rouconk
Chatooka
Neusiok
EARLY ALGONKIAN
TRIBES AND TOWNS
LATER HISTORIC TRIBES
SHOWN IN PARENTHESES

The prime documentary sources for the ethnogeography and ethnohistory of the Roanoke experiment are White's map (15) and Ralph Lane's *Account of the particularities of the imployments of the English men left in Virginia by Sir Richard Greenevill* (16). In spite of the development of unfriendly relations between the natives and colonists under Lane's governorship, Lane's account shows him to have been an individual of ethnological discernment. His narrative is the only Roanoke relation of more than perfunctory value for the student interested in the location, distribution, and relationships of the Carolina Algonkians and their neighbors in 1585. De Bry seems to have sensed its importance in this respect as early as 1590, for although this publisher chose Hariot's *Report* in preference to Lane's *Account* for the first volume of his *Voyages* (17), his map is based upon White's with additions of some of the locations mentioned in Lane's account (18). Both maps are therefore useful for the study of the tribal geography and the native history of the period. New maps of Carolina did not appear until the latter part of the next century (19), by which time the Algonkian tribes were so reduced in both population and culture as to be deemed unworthy of recognition by contemporary cartographers. Lawson was the only writer of the period of permanent settlement who took generous cognizance of the existence of the native tribes of Carolina; his map, however, shows but three names of Indian derivation in the Algonkian area, and these were used as place names rather than as designations of tribal locations (20).

References to locations in the Roanoke relations show that the explorations made by Lane and his colonists apparently took them to most of the important tribal towns inhabited by the Algonkian groups of the Sound area at the time. Their discoveries were confined largely to the shores and islands of Pamlico and Albemarle Sounds, and to the coastal area bordering the bays and rivers adjacent to the larger bodies of water. A trip was made to the Chesapeake tribe situated at the southern end of Chesapeake Bay, and two voyages were made into the interior in explorations of the Chowan and Roanoke Rivers. One exploration was made southwestward from Roanoke, probably as far as the Neuse River, but contemporary knowledge of the region south of the lower Pamlico River seems uncertain and ill-defined. In a concluding passage of Hariot's *Report* it is stated that "al which I have before spoken of have bene discovered and experimented not farre from the Sea coast, where was our abode and most of our traveling; yet sometimes . . . we made our journeys further into the maine and Countrey" (21). Hariot elsewhere referred to discoveries 80, 120, and 150 miles from Roanoke (22). Lane was still more specific with respect to the distances and directions involved in the exploratory expeditions under his direction. In the ethnogeographically most explicit passage of the relations he described the explorations of the colonists as follows:

> Our discoverie . . . of the Countrey . . . hath beene extended from the Iland of Roanoak, the same having bene the place of our settlement or inhabitation, into the South, into the North, into the Northwest, and into the West.
>
> The uttermost place to the Southward of any discovery was Secotan, being by estimation fourescore miles distant from Roanoak. The passage from thence was through a broad sound within the mayne, the same being without kenning of lande, and yet full of flats and shoals. We had but one boate, which could not carry above fifteene men . . . Winter being at hand we thought good wholly to leave the discovery of those parts untill our stronger supply.
>
> To the Northward our furthest discovery was to the Chesepians [Chesapeake], distant from Roanoke about 130 miles. The passage to it [Currituck Sound] was very shallow and most dangerous . . . The territorie and soyle of the Chespians, being distant fifteene miles from the shoare . . . is not to be excelled by any other whatsoever. There be sundry Kings, whom they call Weroances, and Countreys of great fertility adjoyning to the same, as the Mandoages, Tripanicks, and Opossians, which all came to visite the Colonie of the English, which I had for a time appointed to be resident there.
>
> To the Northwest the farthest place of our discovery was to Chawanook, distant from Roanoak about 130 miles. Our passage thither lyeth through a broad sound [Albemarle], but all fresh water, and the chanell full of shoales. The Townes about the waters side situated by the way are these following: Passaguenoke The woman's Towne, Chepanoc, Weapomeiok, Muscamunge, & Metackwem, all these being under the jurisdiction of the king of Weapomiok, called Okisco.
>
> From Muscamunge we enter into the River and

jurisdiction of Chawanook. There the River beginneth to straighten untill it come to Chawanook, and then groweth to be as narrow as the Thames betwene Westminster and Lambeth. Betwene Muscamunge and Chawanook upon the left hand as wee passe thither is a goodly high land, and there is a Towne which we called The blinde Towne, but the Savages called it Ohanoak, [which] hath a very goodly corne field belonging unto it. It is subject to Chawanook.

Chawanook it selfe is the greatest Province & Seigniorie lying upon that River, and the very Towne it selfe is able to put 700 fighting men into the fielde, besides the force of the Province it selfe . . .

Very neere [to the mouth of Chowan River] . . . directly from the West runneth a most notable River, and in all those parts most famous, called the River of Moratoc [Roanoke]. This River openeth into the broad Sound of Weapomeiok [Albemarle] . . . Moratoc it selfe . . . is a principall Towne upon that River . . . The Mangoaks . . . is another kinde of Savages dwelling more to the westward of said River (23).

Lane proceeds to describe his exploration of the Roanoke River to a point that took the party more than 160 miles from Roanoke Island. The exploration led them into the territory of the Mangoak, or Mandoag (24), the Carolina Algonkian term for their western Iroquoian neighbors (25). The foregoing passage is of special interest in its references to the locations and towns of the Weapemeoc, Secotan, and Moratoc tribes. These positions can be determined with greater exactness by reference to the data of contemporary cartography. For collateral textual evidence, however, it is necessary to consider passages from two other relations.

The voiage made by Sir Richard Greenvile for Sir Walter Ralegh, to Virginia, in the yeere 1585 (26) is in the form of a brief journal of the daily experiences of the English during the two months that Grenville was in the colony. Its references to native locations are as follows:

The 26 [of June] we came to anker at Wocokon . . . The 3 [of July] we sent word of our arriving at Wococon to Wingina at Roanoak . . . The 6 M. John Arundel was sent to the maine, and Manteo with him, and Captaine Aubry and Captaine Boniten the same day were sent to Croatan . . . The 8 Captaine Aubry and Captaine Boniten returned . . . To Wocokon. The 11 day the Generall [Grenville, with Lane, Hariot, Amadas, John White] . . . and divers other Gentlemen . . . passed over the water from Wocokon to the maine land . . . in which voyage we first discovered the townes of Pomejok, Aquascogoc, and Secotan, and also the great lake called by the Savages Paquipe, with divers others places . . . The 12 we came to the Towne of Pomeiok. The 13 we passed by water to Aquascogok. The 15 we came to Secotan, and were well entertained there of the Savages.

The 16 we returned thence, and one of our boates with the Admirall was sent to Aquascogok, to demaund a silver cup which one of the Savages had stollen from us, and not receiving it according to his promise, we burnt and spoyled their corne and Towne, all the people being fled (27). The 18 we returned from the discovery of Secotan, and the same day came aboord our Fleete ryding at Wococon. The 21 our Fleete ankering at Wococon, we wayed an anker for Hatoraske. The 27 our Fleete ankered at Hatorask, and there we rested. The 29 Grangino, brother to King Wingina, came aboord the Admirall, and Manteo with him. The 2 [of August] the Admiral was sent to Weapomeiok. The 5 M. John Arundell was sent for England. The 25 our Generall wayed anker and set saile for England (28).

The above locations occur on the maps of White and De Bry and can be transferred to modern maps with the aid of such supporting geographical information as can be found in the narratives of the colony. A passage from Barlow completes the roster of native place names as they occur on the early charts. Barlow's information is a supplement to that of the other relations, for it mentions two tribes, the Pomouik and Neusiok, that are not referred to by Hariot, Lane, or White. His facts, however, are from native informants rather than based upon his own discovery or exploration. His references are as follows:

My selfe with seven more went twentie mile into the River that runneth toward the Citie of Skicoak, which River they call Occam (29), and the evening following wee came to an Island, which they call Roanoak, distant from the harbour [inlet] by which we entred seven leagues. At the North end thereof was a village of nine houses, built of Cedar, and fortified round about with sharpe trees to keep out their enemies, and the entrance into it made like a turne pike very artificially (30). When wee came towardes it, standing neere unto the waters side, the wife of Granganimo, the kings brother, came running out to meete us very cheerefully and friendly. Her husband was not then in the village . . .

Beyond this Island there is the maine lande, and over against this Island falleth into this spacious water, the great river called Occam (31) by the inhabitants, on which standeth a toune called Pomeiock. And sixe dayes journey from the same is situate their greatest citie, called Skicoak,

which this people affirme to be very great; but the Savages were never at it, only they speake of it by the report of their fathers and other men, whom they have heard affirme it to bee one houres journey about.

Into this river falleth another great river, called Cipo, in which there is found great store of Muskles in which there are pearles. Likewise there descendeth into this Occam another river, called Nomopana [Chowan River], on the one side whereof standeth a great towne called Chawanook, and the Lord of that towne and countrey . . . is not subject to the kind of Wingandacoa (32), but is a free Lord . . .

Towards the Southwest foure dayes journey is situate a towne called Sequotan, which is the Southermost towne of Wingandacoa, neere unto which [is] . . . an out Island, unhabited, called Wocokon . . . Adjoyning to this countrey aforesaid called Secotan beginneth a countrey called Pomouik, belonging to another king whom they call Piamacum, and this king is in league with the next king adjoyning towards the setting of the Sunne, and the countrey Newsiok, situate upon a goodly river called Neus. These kings have mortall warre with Wingina, king of Wingandacoa but about two yeeres past there was a peace made betweene the King Piemacum and the Lord of Secotan, as these men which we have brought with us to England have given us to understand (33). But there remaineth a mortall malice in the Secotanes for many injuries and slaughters done upon them by this Piemacum . . .

Beyond this Island called Roanoak are maine Islands . . . with many townes and villages along the side of the continent, some bounding upon the Islands, and some stretching up further into the land (34).

Barlow's narrative is one of the most valuable minor histories of English colonization in the New World. Although its geography is largely based upon the reports of his native informants, supplemented by such explorations as could have been made in a few weeks by a small party in two barks, it is none the less valuable on that account. It offers the most direct and detailed information concerning the political organization and intertribal relationships of the coastal Algonkian groups that is available for this region. It is the first record of white contact with the natives of the Sound area, and it is, therefore, impossible to come nearer to the local precontact aboriginal culture by historical methods of investigation than by a study of its descriptions of the native way of life (35). Barlow's relation, though shorter than Hariot's *Report*, is more genuinely ethnological and is more valuable for its general cultural description than for its allusions to tribal geography. It is characterized by numerous naïvetés and contains some items of misinformation (36), but when it is remembered that the first voyage was made to a strange environment and that Barlow was at first without command of the Algonkian language, the information embodied in his account seems all the more remarkable. Lane's and Hariot's works are longer and for some aspects of ethnology more explicit; both of these writers, however, were in the Algonkian area approximately a year, and they had in Manteo a native informant who had been in England five to six months and must have acquired in that time a working knowledge of the English language.

LATE SIXTEENTH CENTURY TOWNS AND TRIBES

Apart from the above-quoted passages from Carolina's first historians, the data of the narratives respecting tribal names, locations, and relations are scattered and fragmentary. When collected, collated, and interpreted in the light of independently established historical and ethnological facts, it is possible to suggest the following with respect to the location of tribal territories, the towns within them, and the relationship of the tribes to each other in the area of Algonkian occupancy:

The Weapomeiok, or Weapemeoc (37), inhabited the area north of Albemarle Sound, including the four northeastern present counties and perhaps also the southern part of Chowan County. White's map specifies four native towns in this area as "Weapemeoc(an)"; while De Bry's map and succeeding ones designate the entire area north of Albemarle Sound and east of Chowan River as belonging to the same group. Their northern neighbors were the Chesapeake, a tribe on the south bank of the James River, which then inhabited the two southeasternmost counties of present Virginia; their western neighbors were the Chowanoc, who occupied both banks of the river which took their name. The Weapemeoc "king," or chief, in 1585 was Okisco, whose relations with the chieftains of neighboring groups reveal the native political

status of his own tribe. He was independent of Menatonan, chief of the Chowanoc, but was dominated to some extent by the latter, by whom he was induced to acknowledge subjection to the English. Lane states that Menatonon "commaunded Okisko, King of Weopomick, to yeelde himselfe servant and hommager to the great Weroanza (38) of England, and after her to Sir Walter Raleigh; to perfourme which commandement received from Menatonon the sayde Okisko . . . sent foure and twentie of his principallest men to Roanoak . . . to signifie that they were ready to perfourme the same, and so had sent there his men to let mee knowe that from that time forwarde hee and his successours were to acknowledge her Majestie their onely Soveraigne" (39).

Although subservient to the Chowanoc chief, Okisko conducted himself independently of Pemisapan, chief of the Secotan, in the latter's conspiracy against the colonists. Pemisapan, as chief of the natives of Roanoke Island and the adjacent mainland (40), had hoped for Okisko as an ally in his plans for an attack upon the English. "Okisko, king of Weopomeiok [was to] . . . be mooved, and with great quantitie of copper intertained, to the number of 7 or 8 hundred bowes, to enterprise the matter" of attack. Pemisapan dispatched messengers to Okisko, who were "with great imprest of copper in hand" and who made "large promises . . . of greater spoile." Okisko, however, sent word to Pemisapan that neither he nor "any of his especiall followers" would be "of the partie . . . and therefore did immediately retire himselfe with his force into the maine." But "Weopomeiok . . . was devided into two parts, [and] . . . the rest of the province accepted" Pemisapan's proposition and "received the imprest" (41).

The Weapemeoc are thus revealed as a tribe separate from and independent of their neighbors to the west and to the south, although Okisko's authority as a chief seems to have been somewhat weaker than that of his neighboring chieftains in their jurisdictions. The reference to the possibility of drawing upon 700 or 800 warriors from Weapemeoc territory suggests a total tribal population of at least 2,500 (42). Lane's figure of the number of warriors north of Albemarle Sound may be unduly exaggerated, as most contemporary estimates are (43); on the other hand, Mooney's calculation of a total population of 800 for the "Weapemeoc of 1585" would seem to be unreasonably conservative (44). Perhaps 500 warriors, with a total population of 1,500 to 1,750, would be a reasonable estimate.

Some of Okisko's "principallest men" were the chiefs of towns within the territory of what the English called his "kingdom." There are records of four towns within Weapemeoc tribal limits—Pasquenoc, Chepanoc, Weapemeoc, and Mascoming. Here, as usual, the chief tribal town was of the same name as the tribe. Lane's enumeration of them in the order above given may indicate that this was their relative location from east to west, for he mentioned them in this order in a context in which he described crossing Albemarle Sound in order to enter the Chowan River. His reference to them as "about the waters side" suggests that they were on the shore of the Sound, probably at or near the mouths of the northern rivers. The Eastern Algonkian were notable rivermen, and their villages were located, if possible, on the necks of land formed by converging streams (45). With these considerations in mind, and with the aid of White's and De Bry's maps, it is possible to suggest locations of the Weapemeoc settlements more specifically as follows:

On the De Bry map and its copies Pasquenoc, or the "Woman's Town," is placed on the second point of land west of Currituck Sound; this would be modern Camden Point, in southern Camden County, between the North and Pasquotank Rivers. It is entirely possible, as Mooney suggested, that Pasquotank as the name of the river and the modern county is a corruption of the name of this early native village (46). Lawson located a "Paspatank" Indian town, with ten warriors, in this vicinity in 1709 (47). Mooney's location of Pasquenoc "on the north shore of Albemarle sound perhaps in Camden county" (48) would place the town at Camden Point. Hawks claimed to "have no difficulty in fixing the

locality of Passaquenoke," but his location of it "in the southwest corner of the present county of Pasquotank" (49) places it too far to the west. It is impossible to use White's map for a specific location in this instance, for the map shows but one river flowing into Albemarle Sound from the north, and it is impossible to decide which river is intended. However, White's "Masequetuc" is undoubtedly synonymous with the Pasquenoc of other sources. Gerard's derivation of the latter term from *pasakwen-ok*, meaning "close together people," is an attempted etymology with a meaning appropriate enough for any native town or village. Speck's analysis of *pa-skwen-ok* as "woman's town or village" is more in accord with Lane's information; on the same basis White's term *ma-skwe-tuk* would mean "woman's river" (50). There can be no doubt that the settlement and river referred to were on the eastern edge of Albemarle Sound; White's and De Bry's maps so designated the village, and Lane clearly indicated an eastern location in a passage describing his return from exploring the Roanoke River: "I thought it good for us to make our returne homeward [i.e., toward Roanoke Island], and that it were necessary for us to get [to] the other side of the Sound of Weopemeiok in time, where wee might be relieved upon the weares [weirs] of Chypanum and the womens Towne" (51).

Lane's enumeration of Weapemeoc towns lists Chepanoc, or Chypanum, between Pasquenoc and Weapemeoc, and it was probably likewise geographically situated between them, east of the latter and west of the former. It is missing from White's original map, but on De Bry's chart "Chapanun" (52) is placed on a river approximately midway between Pasquenoc (Camden Point) and the Chowan River. Transferred to a modern map this would be Perquimans River. Hawks places "Chepanock . . . in the lower part of Perquimons county, near the sound" (53), but De Bry's map has the town up the river a distance, perhaps near present Hertford; Smith's map, which was but a copy of De Bry's, shows Chepanu in the vicinity of modern Chapanoke, in Perquimans County, and there is no doubt that the present town's name was derived from the Indian term. However, Chepanoc may have been located on Harvey or Stevenson Point, on either side of the mouth of Perquimans River, for there is no reference in any of the relations to the explorers ascending rivers other than the Chowan, Roanoke, Pamlico, and perhaps the Neuse. Lane placed it "about the waters side" of Albemarle Sound and elsewhere stated that "upon Easter day [1586] in the morning, the winde comming very calme, we entred the sound [at the mouth of Roanoke River], and by foure of the clocke we were at Chipanum . . . The next morning wee arrived at our home, Roanoak" (54). This definitely locates the town some distance east of the Chowan and Roanoke Rivers, with a site "on Albemarle sound, in Perquimans county" (55) perhaps as near as can be come to the matter.

It is clear that Weapemeoc was the name of a town as well as of the tribe, but it is impossible to locate the town exactly, as the district, rather than the settlement, is the only location by that name that occurs on the maps of White and De Bry. White's four Weapemeoc towns occur on his map north of the western part of the Sound, in the area of present southeastern Chowan and western Perquimans Counties. Lane's list of towns north of the Sound implies that Weapemeoc was west of Chepanoc, which we have already located on Perquimans River. The tribal town and chief's residence may have been on the Yeopim River near its mouth, and it is altogether possible that Yeopim as the name of the river is a contraction of Weapem-eoc (56). It is impossible to support Mooney's statement that the town "seems to have been in Pasquotank county," and Tarbox's allusion to it as "in what is now Perquimans or Pasquotak County" is a mere guess, made without reference to contemporary cartography and based upon a misunderstanding of Lane's narrative in which his note is offered as explanation (57).

White's map shows Mascomenge as a Weapemeoc town, and De Bry's map locates Mascoming in what would now be southern Chowan County, near or at modern Edenton. Smith's map copies the name from De

Bry but places the town inland from the sound (58). Lane's statement that "from Muscamunge we enter into the (Chowan) River and jurisdiction of Chawanook" (59) indicates the town was in southern Chowan County, near the mouth of the river and on the north shore of the sound. This was the interpretation of Mooney, who placed the village "on the northern shore of Albemarle sound, in Chowan county"; Hawks was again incorrect in locating "this town . . . on the lower waters of the [Chowan] river on their eastern side . . . [some distance] above the sound proper" (60).

Lane included Metackwem (Metocaum) among his Weapemeoc towns, and White listed both Warowtani (Maraton) and Cautaking (Catoking) as belonging to the Weapemeoc. It seems possible, however, that all three of these were Chowanoc villages. The evidence is entirely that of location and geographical distribution, but owing to the crudity of early maps and the indefiniteness of early textual references it is impossible to draw tribal boundary lines with exactness. These three towns were in the region that marked the division between the territory of the Chowanoc and the Weapemeoc, and they may have belonged, therefore, to either of the two groups.

The most detailed information concerning the Chowanoc tribe comes from Lane, and his most explicit reference to the "Chawanook . . . Province and Seigniorie" and the towns within it is the one already quoted. He located the town of Chawanook "about 130 miles . . . distant from Roanoak," where "the River beginneth to straighten untill it . . . groweth to be as narrow as the Thames betwene Westminster and Lambeth" (61). The Chowan River begins to straighten and is narrow in the area that separates modern Hertford and Gates Counties, and it is this upper course of the stream that seems to have been the center of Chowanoc territory in 1585. White's map shows Chowanooc on the west bank of the river, just below a small tributary that may have been meant for Wiccacon Creek in eastern Hertford County. This map carries White's symbol for a native town or village, whereas De Bry's and subsequent maps show Chawanook as a district rather than as a town site. On these maps the territory of the tribe is indicated as still farther up-river, in and around the neck of land formed by the convergence of the Meherrin and Nottoway Rivers to form the Chowan. This location makes the Chowanoc the northernmost Algonkian tribe of the Carolina area and indicates that they were the immediate southern neighbors of the linguistically related tribes inhabiting the south bank of the James River in Virginia (62).

The northern position of the Chowanoc is confirmed by the narratives of the Jamestown colony. Both Smith and Strachey mention the "Chawonokes," or "Chawonocks," as among the "many severall nations of sundry languages that environ Powhatans Territories" to the south (63). Smith was told that the "Chawwonocke" lived "one daies journey" from the Nansemond tribe on the Nansemond River (64). In January, 1609, Michael Sicklemore, a member of the Jamestown colony, was sent from Warraskoyak (Burwell's Bay, James River, northern Isle of Wight County, Va.) to "Chowanoke" with Warraskoyak Indian guides to look for Raleigh's lost colonists and for silk grass. He returned with "little hope and less certainetie" of the fate of the lost Englishmen, reporting the river to be "not great, the people few, the country mostly over growne with pynes, where there did grow here and there straglingly Pemminaw, [which] we call silke grasse. But by the river the ground was good and exceeding furtill" (65). Thirteen years later, in February, 1622, John Pory went to "the South River Chawonock, some sixtie miles over land" from Jamestown, and reported finding "a very fruitfull and pleasant Country, yielding two harvests in a yeare, and . . . much of the Silke grasse." He was "kindly used by the people" there, although we are told nothing of their number or condition at that time (66). They were probably reduced in number, for by the middle of the century they were a mere remnant of the strong and numerous group described in 1585. They were referred to in 1650 as friends of the Powhatan tribes of Virginia and as the enemies of the Iroquoian-speaking Tuscarora, Meherrin, and Not-

taway tribes then inhabiting the Roanoke River region and the area west of the Chowan (67).

The Chowanoc were described as the leading tribe north of Albemarle Sound at the time of the Roanoke settlement. Lane referred to them as a "more valiant people and in greater number" than other tribes of the region (68) and reported that Chawanook, the chief town of the tribe, was "able to put 700 fighting men into the fielde, besides the force of the Province itselfe" (69). He also had heard of and believed that a "generall assembly" had been called by Menatanon, the Chowanoc chief, consisting "of all his Weroances and allies to the number of three thousand bowes." Among Chowanoc allies in this instance were the Mangoak, who were reported as "able of themselves to bring as many more to the enterprise" of the tribal conspiracy against the English (70). These figures are clearly exaggerated, for they were given Lane by Pemisapan, who was attempting to impress the English with the great strength of the natives in case of trouble with the colonists. There was no town in this part of native America with as many as 700 warriors, or a total population of 2,000 to 2,500. It is well to remember Hariot's sober observation that "their Townes are but small, and neere the Sea coast but fewe, some contayning but tenne or twelve houses, some 20; the greatest that we have seen hath bene but of 30 houses" (71).

Hariot's *Report* has several other passages that may apply to the Chowanoc. We can not be sure that Hariot was among the colonists who explored the Chowan River, for he says that "some of our company . . . have wandered in some places where I have not bene" (72), but that he was on one of the expeditions of western exploration—either that of the Chowan or of the Roanoke River—is certain, for he stated that "sometimes we made our journeys further into the maine," and he described the physical features of the inland area as one could only from personal observation. He observed that the interior was "more inhabited with people, and of greater pollicie [governments] and larger dominions, with greater townes and houses" (73). Discussing the number of villages to be found within a tribal territory, he said that "in some places of the Countrey one onely towne belongeth to the government of a Wiroans or chiefe Lord, in other some two or three, in some sixe, eight, and more. The greatest Wiroans that yet wee had dealing with had but eighteene townes in his government, and able to make not above seven or eight hundreth fighting men at the most" (74). It is probable that Hariot here referred to the Chowanoc tribe, for Lane called it "the greatest Province" and was particularly impressed with the power of its chief and the size and strategic situation of its towns. With respect to tribal population Hariot is almost certainly more correct than Lane, and if we allow the whole tribe, rather than one of its towns, a warrior population of 700 to 800, its total population may have been approximately 2,500. Mooney's figure of 1,500 for the period of first contact is an estimate that errs on the side of conservatism (75).

If the Chowanoc tribe had 18 towns at the time of the Roanoke colony, we know the names of less than half of them. This is not a surprising circumstance when it is realized that there is record of only one visit of the English to the area of the upper Chowan River. It seems reasonable to suppose that the town of Chawanook, from which both the river and the tribe took its name, was located in the approximate geographical center of the territory of the tribe, and, as we have seen, both Lane's description and White's map locate the town on the upper river. This would place the tribal capital, i.e., the chief's residence, at a site in either eastern Hertford County or southern Gates County. The sense of the relations is unanimously to the effect that the nucleus of Chowanoc territory and the center of tribal strength were in this region. On this basis Mooney located the tribe, perhaps too far northwestward, "on Chowan river, about the junction of Meherrin and Nottaway rivers" (76). and Tarbox stated that "the country of Chawanook appears to have been about the upper waters of Chowan River" (77). Hawks located the tribe somewhat farther to the south; in one reference he placed the "jurisdiction of Chawanook . . . on the upper waters of the Cho-

wan" and placed the town "on the eastern side of Chowan [River] . . . below the point at which Bennet's Creek enters the Chowan. It was in the northern part of Chowan county" (78). Elsewhere, however, he found it "hard to resist the conviction that the name of the town is retained in the county we now call Chowan; and if so, the locality of Chawanook was in that district of country." His first proposition is correct, but his conclusion is wrong, for native names in modern nomenclature are unreliable indices of aboriginal location unless supported by collateral information. Hawks's further assumption that "the ancient native town may have been but the predecessor of our Edenton, or at any rate not far from its site" (79), is contrary to the testimony of the contemporary documents he printed.

There were probably Chowanoc towns on the lower course of the river, however. We have seen that the territory of the Weapemeoc tribe included the four northeastern modern counties of North Carolina, and perhaps also the southeastern part of Chowan County. Mooney omitted Chowan County from his statement of Weapemeoc distribution (80), and Speck gives the tribe's location as "north of Albemarle sound, west to Edenton" (81). The Weapemeoc town of Mascoming, near present Edenton, seems to have been near the western boundary of Weapemeoc territory. This location of the boundary leaves the eastern bank of the lower Chowan River and the greater portion of present Chowan County the possession of the Chowanoc tribe in 1585. Speck states that the Chowanoc lived on the eastern bank of the river, west and to the north of Edenton, and his map of tribal locations shows the tribe on both banks of the lower river, extending northward to the region east of the confluence of Meherrin and Nottoway Rivers (82). Contemporary sources indicate Chowanoc distribution to have included the territory adjacent to both banks of the river, to and including that portion of land in present northern Hertford County bounded by Meherrin River to the south and west, Nottoway River to the east, and the Virginia–North Carolina line to the north. This distribution is suggested not only by the northern extension of Chowanoc territory already discussed, but also by Lane's statement that "from Muscamunge [i.e., Edenton] we enter into the River and [into the] jurisdiction of Chawanook" (83). Barlow also understood the Chowan River (which he called the "Nomopana") to be the jurisdiction of the Chowanoc tribe. His account gives the impression that there were two divisions of this tribe—a southern one on the lower river, and a northern division "beyond," i.e., farther up the river: "There descendeth into this Occam [Albemarle Sound] another river, called Nomopana, on the one side whereof standeth a great towne called Chawanook, and the Lord of that towne and countrey is called Pooneno. This Pooneno is not subject to the king of Wingandacoa [Roanoke Island and the mainland west of it and south of Albemarle Sound], but is a free Lord. Beyond this country is there another king, whom they call Menatonon, and these . . . kings are in league with each other" (84). Barlow's information was not first-hand, for his expedition did not explore the river, and he was mistaken in understanding Pooneno to have been the resident chief at Chawanook. Menatonon was then the tribal chief, but Pooneno may have been the chief of one of the lower towns near the mouth of the river. That there were several towns belonging to this tribe is made clear by both contemporary narratives and maps. They can be located with some degree of accuracy as follows:

Chawanook, the principal town of the tribe, was located on the river in the area where present Hertford, Gates, and Chowan Counties meet.

Ohanoak seems to have been the second most important Chowanoc settlement. The only specific reference to it is made by Lane, who says that 'Betwene Muscamunge and Chawanook upon the left hand as we pass thither is a . . . Towne which we called The blind Towne, but the Savages called it Ohanoak . . . It is subject to Chawanook" (85). This clearly locates Ohanoak on the western bank of the lower river, in eastern Bertie County, probably below the present town of Colerain. The native town does not occur on White's map, but on De Bry's and Smith's it is shown on the west bank of the

upper river in a position between present Winton and Wiccacon Creek. Smith merely copied from De Bry, and the latter's location is apparently based upon a too northern location of Chawanook. Mooney based his location of Ohanoak on De Bry's map rather than Lane's account, and placed it "on the west side of Chowan river, not far below Nottoway river, probably in Hertford county" (86). Hawks's location "in Bertie [County], on its eastern side, somewhere on the waters of the Chowan" is more accurate, and his suggestion that Roanoke River was named after this town, rather than after the island, is quite possible: "We call it Roanoke, an easy corruption from Ohanoak" (87). It would be interesting to know why the English called Ohanoak the "blind town," but there is no suggestion of the reason in contemporary narratives.

The village of Metackwem (Lane) or Metocaum (Smith) is placed on the De Bry and Smith maps on the west bank of the Chowan River at its mouth, on or near present Salmon Creek. It does not occur on White's map. Mooney lists it as "probably" a Chowanoc town (88), which it would seem to be from the standpoint of location; Lane, however, refers to it as if it were "under the jurisdiction of the king of Weopomeiok" and seems to place it on Albemarle Sound east of Chowan River (89). Following De Bry and Smith, rather than Lane, both Mooney and Hawks located it in southeastern Bertie County, the latter specifying a "few miles north of Walnut Point" (90).

The only evidence for the Chowanoc village of Tandaquomuc is De Bry's map. The term occurs neither in the narratives nor on White's map. Smith failed to copy it from De Bry. The Dutch map of 1621 (91) has it "Tantaquomuck." If De Bry's location is correct the village was on Batchelor Bay, at the west end of Albemarle Sound, between the mouths of Chowan and Roanoke Rivers (92). In this position it would be the southernmost Chowanoc village and on the eastern edge of the territory of the Moratoc.

The village of Waraton, or Maraton, may have belonged to the Weapemeoc rather than Chowanoc tribe. White's map designates it as of the Weapemeoc group. Lane does not mention it by name, but on De Bry's and Smith's maps it is placed on the east bank of the lower Chowan River, De Bry giving it a somewhat more southern location than Smith. Smith's location corresponds to that of the modern village of Mavaton in south central Chowan County, a town that evidently took its name from the Indian word. If a Chowanoc village, it was the only one whose name has been preserved located east of the lower course of the river. It is, in fact, the only known Chowanoc village of 1585 located in present Chowan County.

The two other Chowanoc villages whose names have been recorded for us existed in the northern portion of the territory of the tribe. Catoking occurs on the De Bry and Smith maps at the head of Chowan estuary, apparently on the right bank of modern Bennetts Creek at its mouth. This would place it in southern Gates County, and if our location of the town of Chawanook is correct Catoking must have been situated across the Chowan River from the tribal capital. Mooney's location "about Gatesville" (93) places the town too far to the northwest according to all early maps. White's map, in fact, classifies Cautaking as a Weapemeoc town and places it on the north shore of western Albemarle Sound in southern Chowan County. The name is not mentioned in contemporary narratives.

Another town in Chowanoc territory that does not occur on White's map and is not mentioned in the relations but which is found on De Bry's map and on Smith's, is Ramushonoq. These maps place the settlement between the Meherrin and Nottoway Rivers, in northern Hertford County. Speck notes that *l* and *r* were interchangeable in eastern Algonkian dialects and translates *lamushowok* as "small place or little town [Littleton]" (94). Its small size may account for its lack of mention in the earliest sources. It was the most northern Algonkian town located within the limits of present North Carolina for which there is any record in the historical sources of the Roanoke colony. After the Indian troubles of 1675–1676 the Chowanoc ceded this northern tribal land to the Lords Proprietors, but it was soon preempted by the Iroquoian Meherrin and

Nottoway, who pressed down from more northern locations. Their new residence here was used as a pretext for the boundary-line dispute, which was not settled for over 50 years thereafter (95).

The foregoing seven Chowanoc settlements are less than half of the "eighteene townes in his government" that Hariot ascribed to "the greatest Wiroans that wee had dealing with." The Chowanoc tribe was, however, the largest Algonkian tribe of the coastal Carolina area, and it is, therefore, altogether probable that Hariot alluded to the Chowanoc in his reference to the anonymous "greatest Wiroans." The only larger tribe at this time in the entire region of Virginia-Carolina (96) was the Tuscarora, but these natives were neither Algonkian nor a tribe with which the Roanoke colonists had any contacts. They were not described ethnologically until Lawson published his famous *New voyage of a thousand miles thro' several nations of Indians* in 1709.

A final item of tribal history is of interest in connection with the Chowanoc. The Algonkianist William Jones, himself an Algonkian Indian (Fox) trained in linguistics, derived the tribal name from *shawuni*, "south"; *shawunogi*, "they of the south," or "southerners." The same student derived the word "Shawnee," the name of a Southeastern Algonkian tribe at one time resident in South Carolina, from the same source (97). This linguistic relation does not necessarily indicate a close historic connection between the two groups, although Speck has reminded students "that the Chowan may have been a branch of the wide-spread Shawnee." This relationship is unattested by the sparse historical records for the ethnological Southeast, although Speck argues that "it is possible on the basis of name and location" (98).

A third tribe within the area of Algonkian occupation, near its western boundary, was the Moratoc. From the evidence of location and the fact that Moratoc is an Algonkian-sounding word, I classify this group as Algonkian-speaking. This is inadequate evidence upon which to base linguistic classification, but it is practically all there is available. The only word preserved is the name of the town and tribe. The Roanoke River was called the Moratoc until the eighteenth century (99), and it was upon the banks of the lower Roanoke that this tribe lived in 1585–1586. Speck, who shares the opinion that Moratoc is an Algonkian word, analyzes it as "nice [or] good river" and cites an Algonkian analogy in the Malecite word *wolastaguk*, "beautiful, [or] nice river." Lane says that "The Savages of Moratoc themselves doe report strange things of the head of that River, and that from Moratoc it selfe, which is a principall Towne upon that River, it is thirtie dayes as some of them say, and some say fourtie dayes voyage to the head thereof" (100). Lane's statement reveals that the colonists had had contacts with the Moratoc and that the tribe was located on the lower river. Mooney, who relied upon Smith's second-hand account, rather than upon Lane's original narratives, located the Moratoc "160 miles up Roanoke river, perhaps near the south Virginia line" (101). This is clearly an error in conflict with Lane's information. Mooney's reference to them as "an important tribe which refused to hold intercourse with the English" is also incorrect, for Lane refers to them as a group "with whom before wee were entred into a league, and they had ever dealt kindly with us" (102). The English colonists understood only the Algonkian language and the fact that they had been able to receive "reports" from and enter into a "league" with the Moratoc is the best evidence available that this tribe was Algonkian in speech.

The initial friendly relations between the Moratoc and English did not long continue. By the time Lane and his party were ready to explore Roanoke River the Moratoc had been persuaded by Pemisapan that the English were advancing westward as enemies of the native tribes. As the English proceeded up the river they found that the Moratoc had "abandoned their Townes along the River, and retired themselves with their Crenepos (103) and their Corne within the maine, insomuch as having passed three days voyage up the River wee could not meete a man, nor finde a graine of Corne in any [of] their Townes . . . Wee were then 160 miles from home" (104). The experi-

ence of being unable to trade with the natives was disappointing, for the supplies of the colonists at Roanoke were much depleted by the spring of 1586. Lane laments that "wee had no intention to bee hurtful to any of them, otherwise then for our copper to have had corne of them." The English continued their exploration of the river for two more days until their supplies were exhausted and they were forced to return to Roanoke. Their unsuccessful expedition had taken them into the territory of the hostile Mangoak, who were "another kinde of savages, dwelling more to the westward of the said River." The fact that Lane refers to the Mangoak, who were the Iroquoian-speaking Nottoway, and not to the Moratoc as "another kind" of natives is also presumptive evidence that the Moratoc were Algonkian.

Lane's reference indicates that the Moratoc occupied a considerable stretch of land on the lower course of the Roanoke and that there were at least several towns of the tribe located on the banks of the river. De Bry's map shows but one town and locates it on the second northern bend of the river west of Batchelor Bay. This site would be west of Woodward, in southern Bertie County. Moratoc tribal territory in 1585 probably included southern Bertie and northern Martin Counties and may have extended farther northwestward into the present counties of Halifax and Northampton. The latter area was more likely the territory of the Mangoak, however, who are described as the western neighbors of the Chowanoc (105). Moratoc land may also have extended eastward into present Washington County. On White's map the town of Moratuc is on the south bank of Roanoke River, near its mouth, and just east of a tributary that may have been meant for present Welch Creek. If Moratoc holdings extended east to Albemarle Sound it is possible that the villages of Tandoquomuc and Metocaum also belonged to this tribe, rather than to the Chowanoc. In spite of our inability to establish the exact boundaries of the tribe, it is here suggested that we have in the Moratoc an important Algonkian tribe of the Sound area. It is one whose identity and affiliation have never been recognized, probably because of Mooney's early mistake in placing it in the area of Southeastern Iroquoian distribution (105a).

(To be concluded.)

NOTES

(1) E.g., J. MOONEY, *The Siouan tribes of the East*, Washington, 1894; J. N. B. HEWITT, "Tuscarora," *Handbook of American Indians* 2: 842–853, Washington, 1910; J. R. SWANTON, "Early History of the Eastern Siouan Tribes," *Essays in anthropology in honor of Alfred Louis Kroeber:* 371–381, Berkeley, 1936; F. G. SPECK, "The Catawba Nation and Its Neighbors," North Carolina Hist. Rev. 16(4): 404–417, 1939. C. W. MILLING's otherwise adequate *Red Carolinians* (Chapel Hill, 1940) omits discussion of the Algonkian tribes—another example of their neglect in the history of historical scholarship.

(2) T. MICHELSON, "Preliminary Report on the Linguistic Classification of Algonquian Tribes," 28th Ann. Rep. Bur. Amer. Ethnol.: 221–290, Washington, 1912.

(3) *Lawson's History of North Carolina, 1714*, edited by F. L. HARRISS: 242, 243, Richmond, 1937. All references in this paper will be to this edition of Lawson's *History*.

(4) F. L. HAWKS, *History of North Carolina* 1 (1584–1591), Fayetteville, 1857; E. E. HALE, "Original Documents . . . Illustrating the History of Sir Walter Raleigh's First American Colony," Trans. and Coll. Amer. Antiquarian Soc. 4: 3–33, 317–344, Boston, 1860; I. N. TARBOX, *Sir Walter Raleigh and his colony in America*, Prince Society, Boston, 1884. Hawks and Tarbox reprinted Hakluyt's *Voyages* relating to the Roanoke colony.

(5) The definitive edition of Hakluyt is that of the Hakluyt Society: *The principal navigations, voyages, traffiques and discoveries of the English Nation*, 12 vols., Glasgow, 1903–1905. The Roanoke relations are in vol. 8, pp. 297–422. This edition first included a facsimile of White's original map of the Roanoke region (vol. 8, opp. p. 320). The map is also accurately reproduced in H. S. BURRAGE, ed., *Early English and French voyages, 1534–1608*, opp. p. 248, New York, 1906.

(6) For De Bry's care-free handling of historical materials, see CHESTER M. CATE, "De Bry and the Index Expurgatorius," Papers Bibliogr. Soc. Amer. 11(3–4): 136–140, 1917.

(7) R. G. A(DAMS), "A Brief Account of Ralegh's Roanoke Colony of 1585," William L. Clements Libr. Bull. 22: 14, 16, Ann Arbor, 1935.

(8) White's drawings of Indian subjects afford the student a number of ethnographic details not to be found in the written relations of the Roanoke colony. Bushnell published photographic reproductions of White's original drawings ("John White—The First English Artist to Visit America,

1585," Virginia Mag. Hist. and Biogr. 35(4), 1928, 419–430, 9 pls., 1927; 36(1): 17–26, 5 pls., 1928; 36(2): 124–134, 5 pls., 1928). Bushnell reproduced the entire series of native subjects from White's originals in the British Museum, but he did not reproduce the maps.

(9) The most recent reprint of Hariot's *A briefe and true report* is a facsimile reproduction of the 1588 quarto, with an introductory bibliographical essay by RANDOLPH G. ADAMS (Ann Arbor Facsimile Series, No. 1, 1931). Throughout this paper references to the Roanoke relations, including Hariot's *Report*, will be to the Everyman's Library edition of Hakluyt's *Voyages* (London and New York, vol. 6, 1926). This edition is textually accurate and is the most easily available; moreover, it is unencumbered with inaccurate and misleading interpretive notes such as accompany the reprints by Hawks and by Tarbox (see Note 4).

(10) Hariot's *Briefe report:* 186, 196.

(11) L. S. LIVINGSTON, "Introductory Note" to Hariot's *Report*, p. v, New York, 1903 (Dodd, Mead & Co.'s Facsimile Reprints of Rare Books, Historical Series, No. 1).

(12) Hakluyt 6: 121–132; also in Burrage, *op. cit.*: 225–241.

(13) Hakluyt 6: 196–227; also Burrage, *op. cit.*: 281–323.

(14) P. L. Phillips suggested a number of other reasons for distinguishing the governor and the artist as separate individuals ("Virginia Cartography," Smithsonian Misc. Coll. 14(1039): 1–18, 1896). More recently the tendency has been to regard the governor and the artist as the same person (R. G. ADAMS, "An Effort to Identify John White," Amer. Hist. Rev. 41(1): 87–91, 1935; W. P. CUMMINGS, "The Identity of John White Governor of Roanoke and John White the Artist," North Carolina Hist. Rev. 15(3): 197–203, 1938).

(15) White's map of Virginia (see Note 5) is not to be confused with the map of Virginia and Florida also ascribed to him. (*Principal navigations*, vol. 8: opp. p. 400, Glasgow; also reproduced in E. G. R. TAYLOR, ed., *The original writings and correspondence of the two Richard Hakluyts* 2: opp. p. 414, London, 1935). The Virginia-Florida map occurs among White's original drawings and maps in the Grenville Library of the British Museum. It may have been drawn by him, but the Florida portion is a copy of Le Moyne's map and could not have been based upon White's personal experiences of exploration so far as can be judged from the few known facts of his life. The Carolina portion of the second map is a smaller-scale copy of White's map of Virginia, except that it omits several of the native place names of the larger chart.

(16) Hakluyt 6: 141–162; Burrage, *op. cit.*: 245–271.

(17) De Bry's choice of Hariot's *Report* was recommended by Hakluyt, who was also instrumental in arranging for De Bry's use of White's pictures and maps. For Hakluyt as mediator between White and De Bry, see G. B. PARKS, *Richard Hakluyt and the English voyages*, New York, 1928. For the place of Hariot and White in the work and historical record of the Roanoke settlement, see HENRY STEVENS, *Thomas Hariot, the mathematician, the philosopher, and the scholar*. London, 1900. This biography is inadequate by standards of historical scholarship, but it is the only one available. See also *Dictionary of National Biography* 24: 437–439, 1890.

(18) The De Bry-White map, "Americae Pars, Nunc Virginia Dicta," has been frequently reproduced, most recently by Adams and by Humphreys. A. L. HUMPHREYS, *Old decorative maps and charts:* pl. 27, London, 1926; R. G. A(DAMS), *A brief account of Ralegh's Roanoke colony:* opp. p. 18, Ann Arbor, 1935. With undue modesty De Bry represented White as "authore," himself as merely "sculptore." The White map *via* De Bry became a "mother map" of Carolina and was copied by atlas compilers and professional mapmakers for a century. For its influence on maps of coastal North America compare Humphrey's pls. 42 and 56 with pl. 27, and the latter with pls. 20A, 20B, and 21 in C. O. PAULLIN, *Atlas of the historical geography of the United States*, Washington, 1932. Cf. also pls. 26 and 30 in E. D. FITE and A. FREEMAN, *A book of old maps*, Cambridge, 1926.

(19) W. L. FORD has discussed late seventeenth-century maps of Carolina in "Early Maps of Carolina," Geogr. Rev. 16: 264–273, 1926.

(20) Lawson's map was published as a frontispiece of the 1903 (Charlotte) and the 1937 (Richmond) reprints of his *History*. The 1937 edition is superior textually, but the map of the 1903 edition is on a larger scale. Both are poorly reproduced.

(21) Hariot, p. 193.

(22) *Ibid.*: 171, 186.

(23) LANE, "Imployments," in Hakluyt 6: 141–142, 145, 146. Throughout this paper the original spelling has been retained in all quotations from the sources, but punctuation and paragraphing have been modernized in the interest of preserving the originally intended meaning. All comments in brackets are interpolations by the present writer.

(24) *Ibid.*: 142, 147, 155, 158.

(25) See articles "Nadowa" and "Nottoway" in *Handbook of American Indians* (hereafter referred to as *HAI*), Bur. Amer. Ethnol. Bull. 30, 2: 8–9, 87, 1910. The eponym was an opprobrious epithet meaning "rattlesnake." Carolina maps from 1590 (De Bry-White) to *c.* 1660 locate Mangoak territory west of the area of Algonkian occupation. This location is based upon Lane's account, as Mangoak is absent from White's map.

(26) Hakluyt 6: 132–139. This *Voyage* is sometimes ascribed to Lane but may have been written by Grenville (Tarbox, p. 130n).

(27) This episode marks the beginning of the hostility between the natives and the English which culminated in the "Conspiracy of Pemisapan." Until the sack of Aquascogoc the natives had been friendly. Thereafter Algonkian hostility was a factor in the failure of the Roanoke settlement (see Lane, "The Conspiracie of Pemisapan, the Discovery of the Same, and at the Last, . . . our Request to Depart with Sir Francis Drake for England," Hakluyt 6: 152–162).

(28) *Ibid.*: 137–139.

(29) Occam was the native word for the body of water including the northern portion of Pamlico Sound and Albemarle Sound. Barlow was mistaken in thinking of it as a "river."

(30) White's drawing of Pomeiock shows a similarly stockaded village. White's original has been reproduced by Bushnell and by Binyon. (BUSHNELL, "John White the First English Artist to Visit America, 1585," Virginia Mag. Hist. and Biogr. 35(4): pl. 7, opp. p. 428; and "Virginia—from Early Records," Amer. Anthrop. 9: opp. p.

32, 1907; L. W. BINYON, "The Drawings of John White," Walpole Soc. Publ. 13: pl. 27, New York, 1925.)

(31) In this context Occam refers to Albemarle Sound.

(32) "Wingandacoa" was understood by Barlow to refer to Roanoke Island and the adjacent mainland. Gerard has pointed out that as a locative the term is an "impossible corruption, due to mishearing" a native word supposed to have been *Wingatakw*, meaning "good clothes." (GERARD, *HAI* 2: 957–958.) Raleigh detected Barlow's error, although one wonders how he did so, for in his *History of the world* he wrote: "When some of my people asked the name of the country, one of the savages answered Winganda-coa, which is as much as to say 'You wear good clothes' or 'gay clothes.'" (Cited by GERARD, *HAI* 2: 957, and by HAWKS, *History of North Carolina* 1: 78–79, 1859.)

(33) Amadas and Barlow returned to England in September, 1584, taking with them Manteo and Wanchese, "Two of the Savages, being lustie men." These natives remained in England until April of the next year, when they were brought back to Carolina by Grenville and Lane. Manteo remained a faithful friend of the English colonists, while Wanchese turned against them and became a principal factor in the "conspirary of Pemisapan." Barlow's reference to these men as being in England would seem to date his relation as having been written late in 1584 or early in 1585.

(34) BARLOW, "The First Voyage," in Hakluyt 6: 127–131.

(35) The only other approach toward aboriginal history would be by archeology, but there has been no scientific archeological excavation in coastal Carolina to date.

(36) E.g., "Wingandacoa"; see above, Note 32.

(37) In modernizing the native terms as spelled by the early writers in most instances I have followed the Bureau of American Ethnology "Synonymy" (*HAI* 2: 1021–1178). Speck feels that the Carolinian term *weopim* is cognate with Nanticoke *winquipim*, "sweet fat" or "bear" ("The Nanticoke and Conoy Indians," Papers Hist. Soc. Delaware, new ser., 1: 51, Wilmington, 1927). *Weopim-ok* would thus indicate "bear place"—an appropriate term for this part of Carolina. (SPECK, personal information; *idem*, "Chapters on the ethnology of the Powhatan tribes of Virginia," Indian Notes and Monog. 1(5): 280, 1928: J. LAWSON, *History of Carolina:* 119–121, 1937 reprint.)

(38) The Algonkian tribes from Maryland to Carolina used the word *wiroans* (Hariot), *wiroance* (White), *weroance* (Lane), *werowance* (Smith), to designate a chief, head-man, or "king." Lane's *weroanza* thus refers to "queen." Strachey used "weroanequa" for a native "woman queene" or female chief. (*Historie of Travaile into Virginia Britannia* (*c.* 1616): 56, 196, London, 1849). The word derives from *wiro*, "to be rich"; a chief was "a rich man" or "one who exists in affluence" (GERARD, Amer. Anthrop. 9: 112, 1907; SPECK, *op. cit.:* 275.

(39) Hakluyt 6: 154.

(40) Pemisapan was the same chief whom Barlow had heard of as "Wingina, . . . king [of] . . . the country Wingandacoa" (Hakluyt: 124). But "Pemisapan . . . had changed his name of Wingina upon the death of his brother Granganimo" (Lane, *in* Hakluyt: 146). We are not informed as to the exact nature of the local custom involved in this instance of name-changing; for Algonkian names and naming customs in Virginia, see Strachey, *op. cit.:* 48, 111.

(41) Lane, *in* Hakluyt 6: 155, 157. Lane's relation of Okisko's part in the conspiracy hardly justifies Thomas's remark that "Lane accused him of being the leader in the plot formed by his tribe . . . and other Indians to massacre the colonists" (*HAI* 2: 115).

(42) Smith suggested a warrior to total population ratio of 3 to 10 for 5,000 aborigines within 60 miles of Jamestown (*Map and description of Virginia*, 1612, in E. ARBER, ed., *Travels and works of Captain John Smith:* 65, 360, 1884). Swanton has used a ratio of 1 to 3½ for the tribes of the Southeast (*Indian tribes of the Lower Mississippi Valley:* 39–45, 1911; *Early history of the Creek Indians and their Neighbors:* 421–456, 1922. The latter is an extensive study of the "Population of the Southeastern Tribes" but excludes the Carolina Algonkian).

(43) A. L. KROEBER has made the most competent and comprehensive examination of native American population to date (*Cultural and natural areas of native North America* (ch. 11): 131–181, 1939); that "the vast majority of figures by contemporaries are too large" (p. 180) is one of his concluding "methodological principles."

(44) "The Aboriginal Population of America North of Mexico," Smithsonian Misc. Coll. 80 (7): 6, 1928.

(45) Smith's map of Virginia strikingly shows this, and archeology has proved Smith's map to be remarkably accurate in its location of native town sites. (D. I. BUSHNELL, JR., "Indian Sites below the Falls of the Rappahannock," Smithsonian Misc. Coll. 96(4): 1–65, 1937; M. A. MOOK, "The Anthropological Position of the Indian Tribes of Tidewater Virginia," William and Mary Coll. Quart. Hist. Mag. 23 (1): 27–40, 1943; and, "The Ethnological Significance of Tindall's Map of Virginia, 1608," *ibid.*, 23 (4): 371–408, 1943.

(46) MOONEY, article "Weapemeoc," *HAI* 2: 926.

(47) *History of Carolina*, 1937 reprint, p. 255.

(48) *HAI* 2: 207.

(49) *History of North Carolina* 1: 112.

(50) SPECK, personal information; GERARD, cited by Mooney, *HAI* 2: 207.

(51) Hakluyt 6: 147. The early sources (except Barlow) refer to Albemarle Sound as the "Sound of Weopemeiok." "Weares" refer to wicker structures within which the natives trapped fish; White's drawing of "The Manner of their fishing" shows the method of their construction (Bushnell, 1927, pl. 6, opp. p. 427; Binyon, pl. 26. Cf. these reproductions of White's original with De Bry's pl. 13 for an illustration of the liberties De Bry took in "reproducing" White's drawings).

(52) Apparently a misprint for Chepanun or Chepanum; Smith's map had Chepanu, the Dutch map of 1621 has Chapanun. Until the so-called Horne map of 1666, maps of the Roanoke region were largely copies of De Bry-White. (See Note 18.)

(53) *History of North Carolina* 1: 113.

(54) Hakluyt 6: 150.

(55) *HAI* 1: 244.

(56) Mooney equated the Weapemeoc with the Yeopim, both in name and in identity. The latter is regarded as a later "band or sub-tribe" of the former (*HAI* **2**: 927, 1176; *The Siouan tribes of the East:* 7, 1894).

(57) MOONEY, *HAI* **2**: 926; TARBOX, *Sir Walter Raleigh and his colony in America:* 140n, 1884.

(58) Smith's *Works*, Arbor ed., opp. p. 342; in Smith's paraphrase of Lane's account the name is spelled Muscamunge (*op. cit.:* 312).

(59) Hakluyt **6**: 142.

(60) MOONEY, *HAI* **1**: 810; HAWKS **1**: 113; Hawks based his judgment on Smith's map of 1624, which was by no means a contemporary document and was a copy from De Bry's map, which, in turn, was a free copy from White's. "Nothing is more persistent than a geographical error, unless it be an historical error."

(61) Hakluyt **6**: 142.

(62) For the locations of James River tribes in 1607 see M. A. MOOK, "Virginia ethnology from an early relation," William and Mary Coll. Quart. Hist. Mag. **23**(2): 101–129, 1943.

(63) SMITH, *Map and description of Virginia*, 1612, in Arber, p. 55; STRACHEY, *Historie, c.* 1616, p. 41. Strachey's passage is a practically verbatim repetition of that of Smith.

(64) SMITH, *True relation*, 1608, Arber, p. 32.

(65) *The proceedings and accidents of the English conony in Virginia*, 1612, in Arber edition of Smith's *Works*, pp. 132, 158, 474.

(66) SMITH, *Generall historie*, 1624, Arber, p. 590.

(67) EDWARD BLAND (and others), "The Discovery of New Brittaine, Begun August 27, 1650" (London, 1651), in A. S. Salley, ed., *Narratives of early Carolina:* 8–19, 1911.

(68) Hakluyt **6**: 157.

(69) *Ibid.:* 142. Mooney is mistaken in ascribing 700 warriors to the Chowanoc town of Ohanoak, rather than to the tribal capital of "Chawanook" (*HAI* **1**: 292). Lane's meaning is perfectly clear in his narrative as printed by Hakluyt; Mooney's error is based upon Smith's garbled version of Lane in his *Generall historie* (Arbor, p. 312).

(70) *Ibid.:* 146.

(71) "Briefe and True Report," Hakluyt **6**: 186.

(72) *Ibid.:* 184.

(73) *Ibid.:* 194. The Oxford English Dictionary gives the sixteenth-century meaning of "policy" as "organized state, [or] commonwealth."

(74) *Ibid.:* 186–187.

(75) MOONEY, *The aboriginal population of America north of Mexico:* 6, 1928.

(76) *HAI* **1**: 292.

(77) *Sir Walter Raleigh and his colony in America:* 146n.

(78) *History of North Carolina* **1**: 112–113.

(79) *Ibid.:* 74.

(80) *HAI* **2**: 926.

(81) "The Ethnic Position of the Southeastern Algonkian," Amer. Anthrop. **26**(2): 187, 1924.

(82) *Ibid.:* 188–189.

(83) Hakluyt **6**: 142.

(84) *Ibid.:* 129.

(85) *Ibid.:* 142.

(86) *HAI* **2**: 111.

(87) *History of North Carolina* **1**: 113.

(88) *HAI* **1**: 292, 851.

(89) Hakluyt **6**: 142.

(90) MOONEY, *HAI* **1**: 951; Hawks **1**: 113.

(91) *Documents relative to the colonial history of the State of New York*, edited by E. B. O'CALLAGHAN, vol. 1, frontispiece.

(92) *HAI* **2**: 685.

(93) *HAI* **1**: 219.

(94) SPECK, *The Nanticoke and Conoy Indians:* 56, 57, 1927; MOONEY, *HAI* **1**: 292; **2**: 354.

(95) See R. D. W. CONNOR, *History of North Carolina* **1**: 50–51, for the so-called Chowanoc "war" with the colonists; **1**: 70–71, for Meherrin occupation of former Chowanoc territory.

(96) See MOONEY, *Aboriginal population:* 6, 1928, for comparative tribal population statistics for native Virginia and the Carolinas in 1600. Mooney's figures have been rearranged and reinterpreted by the writer in "The aboriginal population of Tidewater Virginia," scheduled for publication in Amer. Anthrop., April, 1944.

(97) *HAI* **1**: 292; **2**: 530–538.

(98) American Anthropologist **26**(2): p. 187, n. 4, 1924.

(99) Roanoke River is designated Moratoc on the maps of Smith (Arber, opp. p. 342), Horne (1666), Ogilby (1671), and Lawson (1709). The last three are reproduced in O. M. MCPHERSON, *Indians of North Carolina* (Senate Doc. 677): 89, 91, facing p. 100, 1915.

(100) Speck, personal information; Hakluyt **6**: 145. The "strange things" reported from the head of the river were an inland sea and a "Mineral Countrey," wherein the natives are said to have mined "*Wassador*, which is copper." (*Ibid.:* 145–151. Hariot also reported copper and silver as products utilized by the natives of the inland country; *Briefe report*, Hakluyt, p. 171.)

(101) *HAI* **1**: 942, based upon Smith's *Generall historie* (Arber, p. 312).

(102) Hakluyt **6**: 146.

(103) *Crenepo* meant "woman," according to the vocabularies of Smith and Strachey (Smith's *Works*, Arber, pp. 44, 381; STRACHEY, *Historie*, p. 185). Gerard derived the word from *kerenepeu*, "she carries water," i.e., "water-carrier." (Amer. Anthrop. **5**(2): 324, 1904; **7**(2): 235–237, 1905.)

(104) Hakluyt **6**: 146.

(105) "Overland from Chawanook to the Mangoaks is but one dayes journey from Sunne rising to Sunne setting, whereas by water [i.e., down Chowan River and up the Roanoke] it is seven dayes with the soonest" (Lane, pp. 149, 151).

(105a) I have discussed Moratoc tribal identity and location in "A Newly Discovered Algonkian Tribe of Carolina," Amer. Anthrop., new ser., **45**(4): 635–637, 1943.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE ACADEMY

46TH ANNUAL MEETING OF THE ACADEMY

The 46th annual meeting of the Academy, held in the Auditorium of the Cosmos Club, on January 20, 1944, after the 323d meeting of the Academy, was called to order at 9:40 P.M. by the President, Dr. LELAND W. PARR, with 37 persons in attendance.

The minutes of the 45th annual meeting were approved as published in the JOURNAL 33: 110–116. 1943.

The reports of several officers and of the Committees of Auditors and Tellers were read and accepted. These reports are recorded at the end of the minutes.

After the acceptance of the report of the Committee of Tellers, the President declared the following duly elected to the given offices:

CLEMENT L. GARNER, *President*
F. G. BRICKWEDDE, *Secretary*
HOWARD S. RAPPLEYE, *Treasurer*
WILLIAM A. DAYTON, *Board of Managers to January 1945 to fill an unexpired term*
HENRY G. AVERS, *Board of Managers to January 1947*
FRANCIS M. DEFANDORF, *Board of Managers to January 1947*

The Secretary presented for the Affiliated Societies their nominations for Vice-Presidents of the Academy as follows:

Philosophical Society of Washington—HAROLD F. STIMSON
Anthropological Society of Washington—T. DALE STEWART
Biological Society of Washington—HARRY B. HUMPHREY
Chemical Society of Washington—EDGAR R. SMITH
Entomological Society of Washington—AUSTIN H. CLARK
National Geographic Society—ALEXANDER WETMORE
Geological Society of Washington—HERBERT INSLEY
Medical Society of the District of Columbia—FRED O. COE
Columbia Historical Society—GILBERT H. GROSVENOR
Botanical Society of Washington—L. EDWIN YOCUM
Archaeological Society of Washington—Not functioning for the duration of the National Emergency
Washington Section of the Society of American Foresters—WILLIAM A. DAYTON
Washington Society of Engineers—FRANK B. SCHEETZ
Washington Section of the American Institute of Electrical Engineers—FRANCIS B. SILSBEE
Washington Section of the American Society of Mechanical Engineers—WALTER RAMBERG
Helminthological Society of Washington—EMMETT W. PRICE
Washington Branch of the Society of American Bacteriologists—RALPH P. TITTSLER
Washington Post of the Society of American Military Engineers—WILLIAM N. CORSE
Washington Section of the Institute of Radio Engineers—HERBERT GROVE DORSEY
Washington Section of the American Society of Civil Engineers—OWEN B. FRENCH

The Secretary was instructed by the members present to cast a unanimous ballot for these nominees.

The President, Dr. Parr, announced the recipients of the Academy's Awards for Scientific Achievement for 1943 as follows:

For the Biological Sciences, to JASON R. SWALLEN, Office of the Coordinator of Inter-American Affairs, in recognition of his outstanding contributions to agrostology.

For the Engineering Sciences, to LLOYD V. BERKNER, Commander, U.S.N.R., in recognition of his distinguished service in research on the ionosphere and wave propagation.

For the Physical Sciences, to LAWRENCE A. WOOD, National Bureau of Standards, in recognition of his distinguished service in the investigation of rubber and other high polymers.

The Retiring President announced the appointment authorized by the Board of Managers of a "Committee to Study the Place and Function of an Academy of Sciences in Washington," consisting of AUSTIN H. CLARK, chairman, JOHN E. GRAF, HARRY B. HUMPHREY, RAYMOND J. SEEGER, PAUL A. SMITH, and two additional members to be appointed upon recommendation of Chairman Clark by the incoming President, Capt. CLEMENT L. GARNER. Dr. Parr pointed out that it is intended that this Committee will consider the Academy in rela-

tion to the changed conditions that will probably exist after the war.

The Retiring President, Dr. Parr, appointed Past Presidents TUCKERMAN and CHAMBLISS to escort the incoming President, Capt. CLEMENT L. GARNER, to the Chair. After a short address, Captain GARNER adjourned the meeting.

Report of the Secretary

During the Academy year there were a total of 49 persons (45 resident and 4 nonresident) elected to membership. Of these 49 persons elected, 35 resident and 4 nonresident have qualified for membership, 2 accepted resident membership but have not qualified by payment of dues, and 2 persons declined membership. Six just recently elected have not yet been notified of their election. The new members were distributed among the various sciences as follows: 4 each in biochemistry, mathematics, and physical chemistry; 2 each in physics, cytology, anthropology, geochemistry, entomology, and paleontology; and 1 each in biology, physiology, chemistry, civil engineering, geology, zoology, dendrology, botany, hydraulics, forest ecology, geophysics, hydrology, astronomy, chemical economics, and ichthyology.

Because of their retirement from the active practice of their profession, 8 members (5 resident and 3 nonresident) were placed on the retired list to enjoy all the privileges of active membership without further payment of dues. Resignations were accepted from 4 members in good standing (1 resident and 3 nonresident). One resident and two nonresident members were dropped for nonpayment of dues.

The deaths of 19 members (10 resident and 9 nonresident) were reported, as follows:

WILLIAM CROZIER, Washington, D. C., November 10, 1942.

FRANK D. ADAMS, Montreal, Canada, December 9, 1942.

LEONHARD STEJNEGER, Washington, D. C., February 28, 1943.

MARY JANE RATHBUN, Washington, D. C., April 4, 1943.

WILLIAM A. HOFFMAN, San Juan, Puerto Rico, April 4, 1943.

WILLIAM A. SETCHELL, Berkeley, Calif., April 5, 1943.

ALLEN C. CLARK, Washington, D. C., May 16, 1943.

RICHARD F. JACKSON, Washington, D. C., June 1, 1943.

CHARLES F. MARVIN, Washington, D. C., June 5, 1943.

EDWARD H. BOWIE, San Francisco, Calif., June 29, 1943.

GEORGE W. LITTLEHALES, Washington, D. C., August 14, 1943

LEON W. HARTMAN, Reno, Nev., August 27, 1943.

ALEŠ HRDLIČKA, Washington, D. C., September 5, 1943.

CHARLES E. RESSER, Washington, D. C., September 18, 1943.

NATHAN S. OSBORNE, Washington, D. C., September 18, 1943.

ELMER D. BALL, Pasadena, Calif., October 5, 1943.

FRANK LEVERETT, Ann Arbor, Mich., November 15, 1943.

EDWARD W. PARKER, Philadelphia, Pa., January 3, 1944.

GEORGE OTIS SMITH, Skowhegan, Maine, January 10, 1944.

Of these LEONARD STEJNEGER, MARY JANE RATHBUN, CHARLES F. MARVIN, and GEORGE W. LITTLEHALES were original members. LEONHARD STEJNEGER was also an honorary member.

On January 20, 1944, the status of the membership was as follows:

	Regular	*Retired*	*Honorary*	*Patron*	*Total*
Resident....	429	35	2	0	466
Nonresident.	135	25	16	1	177
Total.....	564	60	18	1	643

The net changes in membership during the past year are as follows:

	Regular	*Retired*	*Honorary*	*Patron*	*Total*
Resident....	+19	−2	−1	0	+16
Nonresident.	− 5	+2	0	0	− 3
Total.....	+14	0	−1	0	+13

During the Academy year 1943 the Board of Managers held 6 meetings, with an average attendance of 17 persons.

During the year the following important matters were before the Board for consideration:

(1) The Washington Academy of Sciences became affiliated with the American Association for the Advancement of Science in 1942, and in 1943 the Academy received from the American Association for the Advancement of Science the Academy's first A.A.A.S. grant for research, this grant amounting to $150. The amount was determined by taking the actual

number of members of the Academy who were in good standing in the Association at the close of the Association's fiscal year ended September 30, 1942, allowing 50 cents each for such paid-up members. The main purpose of the A.A.A.S grants to Affiliated Academies has been to aid young and promising scientists who have worthwhile research projects but lack the funds to continue work on them. The funds may be used for the purchase of necessary equipment or supplies, or for compensation to an assistant, but are not to be used for publication. Research grants may be accumulated for a period of 3 years. Upon recommendation of a special committee consisting of FRANK H. H. ROBERTS, JR., Chairman, R. J. SEEGER, and R. P. TITTSLER, the Academy decided to allow the first A.A.A.S. grant to be accumulated with the grant for 1944. We have already been informed that the grant for 1944 is $207.50, making a total of $357.50 available now to the Academy. This may be awarded during the present year or allowed to accumulate with the grant for 1945.

(2) On September 16 the District of Columbia Dental Society, a component of the American Dental Society, requested affiliation with the Academy. A special committee consisting of F. B. SCHEETZ, Chairman, CHARLOTTE ELLIOTT, and R. P. TITTSLER, was appointed to study the qualifications of the District of Columbia Dental Society for affiliation with the Academy and to report its findings to the Board of Managers. The application of this Society is still pending.

(3) The Board of Managers approved a request of the Board of Editors of the JOURNAL that 50 free reprints of obituaries published in the JOURNAL be furnished to the writers.

(4) The Standing Rules of the Board of Managers were amended to permit payment of dues for fractional parts of a year.

(5) The bylaws were amended by vote of the Academy to permit Academy members to buy life membership by payment of a sum that will provide an annuity certain of $5 a year for a period of years equal to 70 minus the age of the member at the time life membership is bought.

(6) In December the Academy was requested to vote upon an amendment to the bylaws that would extend life membership to all members of the Academy upon retirement from the gainful practice of their profession because of age or disability. The Committee of Tellers will report this evening upon the results of this ballot.

Noteworthy, also, were the efforts this year of officers of the Academy with budgetary allotments to reduce expenditures of their offices consistent with efficient operation. The economies of operation effected during 1943 may not be possible of attainment in future years.

During the Academy year, seven meetings of the Academy were held as follows, beginning with the 317th and ending with the 323d:

On February 18, 1943, HARVEY L. CURTIS presented an address as retiring president entitled *A scientific recreation—The accuracy and extent of measurement.*

On March 18, 1943, the 1942 Academy Awards for Scientific Achievement were presented to ROBERT S. CAMPBELL, of the U. S. Forest Service, for work in the biological sciences; to WALTER RAMBERG, of the National Bureau of Standards, for work in the engineering sciences; and to MILTON HARRIS, of the National Bureau of Standards, for work in the physical sciences.

On April 22, 1943, LINUS PAULING, of the California Institute of Technology, addressed a joint meeting of the Chemical Society of Washington and the Academy on *Chemical studies of the structures of antibodies.*

On October 21, 1943, STEPHEN P. MIZWA, secretary and executive director of the Kosciusko Foundation, addressed the Academy on *Nicholas Copernicus.*

On November 18, 1943, HOWARD WILCOX HAGGARD, director of the Laboratory of Applied Physiology, Yale University, addressed the Academy on *Andreas Vesalius.*

On December 16, 1943, FRED CORRY BISHOPP, of the U. S. Bureau of Entomology and Plant Quarantine, addressed the Academy on *Insects and the war.*

On January 20, 1944, WILLIAM DUNCAN STRONG, professor of anthropology of Columbia University and director of the Ethnogeographic Board, addressed the Academy on *Recent anthropological research in Latin America.*

The meeting on April 22 was held in the Auditorum of the U. S. National Museum; the other six meetings were held in the Assembly Hall of the Cosmos Club.

F. G. BRICKWEDDE, *Secretary.*

Report of the Treasurer

CASH RECEIPTS AND DISBURSEMENTS

RECEIPTS

From dues 1939	$ 5.00
From dues 1940	35.00
From dues 1941	40.00
From dues 1942	115.00
From dues 1943	2,610.92
From dues 1944	40.00
From life membership	79.47
From subscriptions 1942	23.40
From subscriptions 1943	398.45
From subscriptions 1944	408.45
From subscriptions 1945	2.70
From sales of JOURNAL	72.20
From sales of directory, 32d Edition	.25
From sales of directory, 33d Edition	.25
From payments for reprints 1942	203.83
From payments for reprints 1943	430.67
From interest on investments	1,191.19
From credit memo (Am. Sec. & Tr. Co.)	7.50
From refund to meetings committee	4.50
From T. Q. Donaldson (note—paid off)	1,000.00
Total receipts	$6,668.78
Cash balance, Jan. 1, 1943	1,506.06
To be accounted for	$8,174.84

DISBURSEMENTS:

For Secretary's Office 1942	$ 97.25
For Secretary's Office 1943	144.01
For Treasurer's Office	111.27
For Custodian & Subs. Mgr. 1942	12.00
For Custodian & Subs. Mgr. 1943	16.03
For JOURNAL printing 1942	187.11
For JOURNAL printing 1943	2,308.88
For JOURNAL reprints 1942	141.75
For JOURNAL reprints 1943	349.33
For JOURNAL illustrations 1942	2.34
For JOURNAL illustrations 1943	247.41
For JOURNAL Office 1942	23.61
For JOURNAL Office 1943	225.46
For Meetings Committee 1942	38.00
For Meetings Committee 1943	187.53
For Directory	27.37
For debit memos, refunds, etc.	26.85
For Series G Bond	1,000.00
Total disbursements	$5,146.20
Cash balance Dec. 31, 1943	3,028.64
Total	$8,174.84

RECONCILIATION OF BANK BALANCE

Balance as per cash book, 12-31-43		$3,028.64
Bank Balance, Am. Sec. & Tr. Co., as per statement 12-31-43	$3,045.79	
Receipts not deposited	39.30	
	$3,085.09	
Checks outstanding, not cashed:		
No. 170	$21.50	
958	3.00	
963	0.95	
964	18.88	
965	12.12	56.45
		$3,028.64

INVESTMENTS

409 Shares stock of Washington Sanitary Improvement Co., par value $10 per share, cost	$4,090.00
20 Shares stock Potomac Elec. Power Co., 6% Pref., cost	2,247.50
4 Certificates Corporate Stock of City of New York, 1 for $500, 3 for $100, cost	800.00
1 Bond of Chicago Railways Co., #1027; interest at 5%, due 1927, par value $1,000, less $250 paid	750.00
2 Real-estate notes of Yetta Korman et al., dated Oct. 5, 1938, renewed 1941, for 3 years (#7 of 37 for $500 and #8 of 37 for $500), cost	1,000.00
2 Certificates (1 for $4,000 and 1 for $1,000) First Federal Savings & Loan Assn. Nos. 914 & 1063	5,000.00
2 Certificates (1 for $4,500 and 1 for $500) Northwestern Federal Savings & Loan Assn. Nos. 1380 and 1441	5,000.00
5 U. S. Government Series G Bonds at $1,000 each, Nos. M332990G, M332991G, M332992G, M332993G, M180741G	5,000.00
Deposited in Savings Account, American Sec. & Trust Co.	46.65
	$23,934.15
Cash Book balance Dec. 31, 1943	3,028.64
Total Assets	$26,962.79
Total Assets Dec. 31, 1942	$25,404.08
Total Assets Dec. 31, 1943	26,962.79
Increase	$1,558.71

The relatively large increase in the assets of the Academy is more apparent than real. It is impossible at the close of the fiscal year to know exactly what bills are outstanding. We can not even furnish an exact statement as to the relationship between expenditures and allotments, since, for example, we do not yet know exactly what the charges-to-authors increment of the JOURNAL allotment will be. The statement concerning the status of the various allotments will be submitted later as a supplemental report. It is known, however, that, at the time this report is written, $508.40 has been paid out since January 1, 1944, on obligations incurred in 1943 and chargeable to 1943 expenditures. Presumably there will be approximately $50 more that will have to be paid out under these conditions, which leaves the net increase in assets something of the order of $1,000. This results to a great extent from the following:

(1) During the past year we have written off no losses on investments as we have had to do in some recent years.

(2) Officers and committees have apparently stayed well within their budget allotments.

(3) A considerable amount was realized from the collection of back dues.

(4) One life membership was received during the year.

(5) In spite of the fact that 1943 would normally have been a "Red Book" year, the Red Book was not issued, and although preparation of it was begun, the expenditures in connection with the work done so far are relatively small.

(6) As has been shown earlier in this report, a considerable amount of money was received on back interest. This should have been collected previously, but owing to a misunderstanding the interim certificates were not exchanged for coupon certificates until during the year 1943 and then all interest for 1940 to 1943, inclusive, on the $800 investment with the City of New York was received in a lump.

The previous report showed an increase of $703.99 with outstanding bills estimated at $300. Actually, as shown earlier in this report, the outstanding bills finally amounted to $502.56.

However, taking all these factors into account, this report still shows a reasonably healthy increase in the total assets of the Academy and is a welcome change from the condition which existed three or four years ago when we were showing a slight deficit year after year. Your Treasurer feels that, if the officers and committees of the Academy are willing to continue being as frugal as possible in connection with Academy expenditures, we may be able to carry on even in these troubled times and continue to make some slow but steady gain in Academy assets. If, as is planned, the Red Book is issued in 1944, the cost of the publication of the Directory will, of course, tend to offset some of the gain shown for this year.

HOWARD S. RAPPLEYE, *Treasurer.*

Report of the Auditing Committee

The accounts of the Treasurer of the WASHINGTON ACADEMY OF SCIENCES for the year 1943 were examined by your auditing committee on January 17, 1944. Each item of disbursement was found to be duly authorized and supported by a canceled check or a debit memorandum except for the outstanding checks listed in the report. The accompanying report of the Treasurer is in agreement with his records. The securities listed in the report were inspected on January 17, 1944, and were found to be as listed and with all coupons attached that are not yet due.

The accounts of the Treasurer were found to be in excellent shape as indicated by careful, systematic, and orderly arrangement of all items. This greatly simplified the work of the committee and deserves the commendation of the Society.*

C. H. SWICK, *Chairman.*
G. F. GRAVATT.

[One member of the auditing committee, Prof. Frank M. Weida, was unable to assist in the audit because of pressure of work following his recent illness.]

Report of the Archivist

There is very little to report this year. It might be mentioned that the material is stored in a convenient place in my office at the U. S. Plant Industry Station, Beltsville, Md., protected from moisture and dirt as much as can be done in an ordinary building. Although not yet catalogued the material is accessible and has been made use of in connection with the work of various committees of the Academy.

NATHAN R. SMITH, *Archivist.*

* The Treasurer has been without clerical help on his accounts since April, 1943.

Report of the Board of Editors

Volume 33 of the JOURNAL was slightly larger than Volume 32 of the previous year. The 12 issues contained 388 pages distributed among the sciences as follow:

Sciences	No. of papers, 1943	Pages, 1943	Percentages, 1943	No. of papers, 1942	Pages, 1942	Percentages, 1942
Biological	56	293.8	75.4	43	211.8	56.3
Physical	7	47.6	12.4	12	106.2	28.2
General	2	17.8	4.6	2	14.9	4.0
Proceedings	—	25.4	6.6	—	39.1	10.4
Obituaries	—	—	—	—	—	—
Index	1	3.4	1.0	—	4.0	1.1
	65	388.00	100.00	57	376.0	100.0

This volume includes the addresses of the retiring presidents of the Academy and of the Geological Society. It includes one of the addresses given by the three recipients of the Academy awards; the twelfth Joseph Henry lecture and an address delivered before one of the regular meetings of the Academy. Of the 65 papers presented 39, or 60 percent, were presented by members of the Academy. This represents no advance in the number of papers presented by members as compared with the two preceding years. The volume contains 51 line cuts and 12 halftones.

Volume 33 is larger by 12 pages than Volume 32 published in 1942. This small increase is a step in the right direction. The editors and others have long deplored the steady decline in number of pages published by the JOURNAL since 1915. This year, 1943, it was not possible to do much more than arrest the decline of the past years. This unfortunate circumstance did not result so much from a lack of funds as it did to war conditions which prohibited the JOURNAL from using more paper this year than during the previous year.

A glance at the figures showing number of articles and number of pages printed during the year shows a great disproportion of biological papers. This was true last year also, but the 1943 JOURNAL shows a still more important decline in the number of papers and pages published under the heading of Physical Sciences. Only one paper in chemistry was published and this appeared under the heading of Geochemistry. Two papers only fall in the category of Physics. Of the Biological Sciences the largest number of papers appears under the heading of Botany (16); the next in abundance are those classified as Zoology (13). Probably no relief of this situation will occur while the war is still on, making it impossible for some time to balance the JOURNAL better between the Physical and Biological Sciences.

The reduced budget on which the JOURNAL has operated for two years proved adequate through use of the rigid economies instituted in 1942. It will be recalled that the Board of Editors in 1942 eliminated all free reprints and reduced amount of illustration allowed to an author to one full page of line cut or its equivalent in cost. It was also left to the discretion of the editors whether they make charges for exceptional amounts of foreign matter, tabular material or unusual type. The editors were also given authority to charge for unreasonable amounts of galley changes. During 1943 these economies were diligently applied and resulted in a comfortable balance.

In the middle of the year a modification was made in the rule that no free reprints are issued to authors. The change was made in the case of authors of obituaries. It was realized that some hardship and ill will were created by the practice of charging authors for reprints of obituaries, particularly in instances where the editorial Board had actually solicited the obituary. This situation was corrected by allowing 50 reprints free to an author of a signed obituary.

The Board of Managers appropriated to the Editors for printing, illustrating, and mailing the JOURNAL and other items $2,800; for clerical assistance $240; for postage and incidentals $60—a total of $3,100. Of this sum the total amount of $240 was expended for clerical assistance; and postage and incidentals (binding 2 back volumes of the JOURNAL) required $29.56. Printing and mailing the JOURNAL cost $2,540.56, while illustrations cost $258.35. Reprints cost $387.16* making a total paid out by the Academy of $3,186.07.*

The economies discussed above resulted in charges to authors of the following items:

* These figures do not include reprints for December. Inasmuch as the December reprint bill includes no obituaries, this item will be exactly balanced by charges to authors and will not affect the final total saving.

Excess illustration (above 1 page line cut or its equivalent)	104.51
Excess alterations	22.65
Excess typesetting	32.43
Reprints	367.95*
	527.54

Deducting the $527.54 paid by authors from the grand total paid out leaves $2,658.53 net cost to the Academy. A balance of $30.44 remained in the item postage and incidentals and $141.47 in printing and mailing, making a total favorable balance of $171.91.

	Printing and mailing	*Clerical assistance*	*Postage and incidentals*	*Balance*
1943 Budget	$2800	$240	$60.00	
Paid out to Dec. 1943	$2658.53	$240	$29.56	
	141.47	—	30.44	$171.91

The Board of Editors here expresses its deep appreciation for the cooperation of Mr. PAUL H. OEHSER, whose editorial guidance makes possible the general excellence of form and composition of the JOURNAL. The senior editor also thanks his colleagues on the Board for their cheerful assistance and high quality of their work. Special thanks are due JASON R. SWALLEN who managed the JOURNAL between February and June.

G. ARTHUR COOPER.
LEWIS V. JUDSON.

[The third member of the Board, JASON R. SWALLEN, was in Brazil during the latter part of 1943.]

Report of the Custodian and Subscription Manager of Publications

Subscriptions.—No special campaign was inaugurated, owing to the unsettled conditions, for obtaining additional nonmember subscriptions. Our present subscriptions are approximately as follows:

Nonmember subscriptions in United States	100
Nonmember subscriptions in foreign countries	25
Nonmember subscriptions in enemy-controlled areas (inactive)	35
Subscriptions, Geological Society of Washington	12

Stocks of publications.—Thanks to the splendid system adopted by my predecessor, WILLIAM W. DIEHL, the first man to hold this office, the initial responsibilities and organizational work confronting the Custodian of Publications were reduced.

In 1939 the Board of Managers instructed the Custodian to set aside a specific number of volumes to be sold only as complete sets. At that time it was ordered that eight complete sets from Volume 1 to the current volume; six additional sets from Volume 11 to the current volume; and eleven additional sets from Volume 16 to the current volume should constitute the reserve sets. Since 1939 two complete sets from Volume 1 to the current number were sold. Nevertheless, many of our members have kept the Academy in mind when disposing of their own volumes and those of deceased members. As a result of these donations practically two additional sets from Volume 1 onward have been filled.

In view of the possible demand from foreign countries after the war, I have made it a policy to maintain as many complete sets as our stocks of early numbers will permit.

Inventory of stocks as of December 31, 1943.—

Reserve Sets of the JOURNAL:	
Bound Volumes 1–29 and unbound Volumes 30–33	1 set
Unbound Volumes 1–33 (Vol. 2, no. 20 missing)	7 sets
Unbound Volumes 11–33	6 sets
Unbound Volumes 16–33	11 sets
Proceedings of the Washington Academy of Sciences:	
Volumes 1–13, inclusive	50 sets

A miscellaneous series of volumes and separate numbers of the JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES are maintained for sale as back numbers. A detailed inventory of this series is attached. Odd numbers of the Proceedings of the JOURNAL together with Directories and reprints of special articles are also available.

All these volumes, including the reserve sets, except a few after Volume 22, are stored without cost in the Smithsonian Institution and the U. S. Coast and Geodetic Survey. Those few volumes after Volume 22 are stored by the George Banta Publishing Co. at Menasha, Wis.

Sales and expenditures.—During the past year approximately 150 back numbers of the JOURNAL have been sold, proceeds amounting to $72.20. An allotment of $50 was assigned to this office for 1943, of which $16.03 was spent for stamps and clerical assistance, leaving an unexpended balance of $33.97.

FRANK M. SETZLER, *Custodian and Subscription Manager of Publications.*

* Does not include $19.21 paid by Academy for reprints of obituaries.

Report of the Committee of Tellers

A total of 253 envelopes were delivered to the Committee by the Secretary. Of these, four bore no signature and two were communications to the Secretary. In the remaining 247 envelopes there were 236 ballots on an amendment to the bylaws and 240 ballots for officers and managers of the Academy.

The count of ballots on the amendment to Article I, Section 2, of the bylaws extending life membership to members of the Academy who have not been active members for 10 years upon retirement from the gainful practice of their profession because of age or disability with the option to obtain notices of meetings and the JOURNAL at a reduced rate showed: 229 ballots for the amendment and 7 against.

The count of ballots for officers of the Academy showed the following elected:

President, CLEMENT L. GARNER
Secretary, F. G. BRICKWEDDE
Treasurer, HOWARD S. RAPPLEYE
Board of Managers to January, 1945, to complete an unexpired term, WILLIAM A. DAYTON.
Board of Managers to January, 1947, HENRY G. AVERS and FRANCIS M. DEFANDORF.

W. G. BROMBACHER, *Chairman.*
W. D. URRY.
GEORGE R. WAIT.

Submitted by F. G. BRICKWEDDE, *Secretary.*

Obituaries

LEON WILSON HARTMAN was born in Downsville, N. Y., on June 18, 1876, and died in Los Angeles, Calif., on August 27, 1943. During his adult life he was primarily interested in teaching physics. However, he always found time to carry on some research and on several occasions spent a few months or even a year in research work.

Dr. Hartman received his bachelor's degree from Cornell University in 1898 and his master's degree a year later. He continued his graduate work at Cornell for two years, then taught at Kansas State College for a year. He received the Frazier fellowship of the University of Pennsylvania in 1902. This university conferred on him the degree of doctor of philosophy in 1903. Receiving then the Tyndale fellowship, he spent a year at postdoctorship study at Göttingen.

Returning from Germany he started his long career as a teacher of physics; first at Cornell, then at the University of Utah, and finally for 30 years as head of the physics department of the University of Nevada, of which university he was president during the last five years of his life.

When Dr. Hartman was at Göttingen he became interested in research on the Nernst glower, then one of the most efficient devices for converting electrical energy into light. This occupied his attention for a number of years. Later he became interested in researches involving electrical measurements. At the National Bureau of Standards he collaborated in a method of measuring inductance by using a pulsating current.

Dr. Hartman's devotion to teaching culminated in his election to the presidency of the University of Nevada. During the five years of his incumbency he worked unceasingly for its advancement. While on his first vacation for several years, he was stricken with a fatal cerebral hemorrhage.

Dr. Hartman was a member of many scientific and professional societies, among them the Washington Academy of Sciences. He is survived by his widow, Dr. Edith Kast Hartman, and by four children.

H. L. CURTIS.

ELMER DARWIN BALL, whose active career was terminated in February, 1938, by a cerebral hemorrhage, died on October 5, 1943, in Pasadena, Calif., at the age of 73. Dr. Ball was born in Athens, Vt., in 1870, but his family soon after removed to Iowa, which thus became essentially his home state. To Mildred R. Norvell, who survives him, he was married in 1899. Dr. Carlton R. Ball, of Washington, D. C., is a brother.

Iowa gave him his public-school and college education as well as his early teaching experience. He earned the B.S. and M.S. degrees at Iowa State College in 1895 and 1898, and in these early years he taught in the public schools of Iowa and in Albion Seminary, where he was assistant principal for one year. In his alma mater he first served in a scientific teach-

ing capacity as assistant in zoology and entomology, and beginning in 1897 he served four years in a similar capacity at Colorado Agricultural College.

A professorship in the Utah Agricultural College next claimed him, and during his term of service there he earned the Ph.D. degree, granted by Ohio State in 1907, under Prof. Herbert Osborn. From this contact resulted his outstanding life work on leafhoppers and related families of insects. The same year that he received his doctorate, Dr. Ball was elevated to the deanship of the Utah Agricultural College and to directorship of the Agricultural Experiment Station. The writer's 35-year friendship with him dates from this period.

Dr. Ball held membership in a number of the usual professional organizations, including entomological societies and the Ecological Society of America, in addition to membership in the Washington Academy of Sciences and the science academies of five states.

In 1916 Dr. Ball accepted the position of state entomologist of Wisconsin, only to return two years later to Iowa State College as head of the Department of Zoology and Entomology, a position that includes the duties of state entomologist of Iowa. From this position he was granted leave for two years to serve as Assistant Secretary of Agriculture under Secretaries Meredith and Wallace. Giving up his position in Iowa, he served from 1921 to 1925 as director of scientific work in the U. S. Department of Agriculture, where he worked for better salaries for the department's scientific workers.

Dr. Ball served with the Florida State Plant Board, in charge of important celery insect investigations, from 1925 to 1928. The publication on the celery leaf tier by Ball and his coworkers is outstanding in its recognition of the ecological side of the problem and relates the damage done by the insect very specifically to seasonal conditions basically dependent on weather.

In October, 1928, he accepted the deanship of the College of Agriculture, becoming at the same time director of the Agricultural Experiment Station, of the University of Arizona. He transferred in 1931 to teaching and research as professor of zoology and as experiment station entomologist, the position occupied when illness overcame him.

Dr. Ball was an indefatigable investigator, not only in his official positions, but in his private time as well. Officially, he pioneered in codling-moth control, did genetics work in poultry breeding, and was definitely a pioneer in the recognition of transmission of plant diseases, now known to be virus diseases, by insects—a natural corollary of his familiarity with leafhoppers and related sap-sucking insects, to which he so assiduously devoted his every possible hour and vacation. He first recognized the first- and third-discovered instances of insect-transmitted plant diseases—curly top of sugar beets, and tipburn of potato. The Ball collection of leafhoppers and related families is now a part of the National Museum collections.

Dr. Ball with students was enthusiastic and helpful; with coworkers a cheerful and loyal friend.

CHARLES T. VORHIES.

FRANK LEVERETT, a member of this ACADEMY for 30 years, known for years as one of the leading glacial geologists in the United States, died at Ann Arbor, Mich., on November 15, 1943. He was born on March 10, 1859, at Denmark, Iowa, the son of Ebenezer and Rowena (Houston) Leverett. From 1880 to 1883 he was an instructor in natural science at Denmark Academy, Iowa, and on completing studies at Iowa State College he received the B.S. degree in 1886. At times (1909–1929) during his residence at Ann Arbor, Leverett delivered lectures on glacial geology at the University of Michigan, and in 1930 this institution conferred on him the honorary degree of doctor of science.

In 1886–1890 he served on the U. S. Geological Survey as field assistant under the direction of Dr. Thomas C. Chamberlin, geologist in charge of the Glacial Division. Thus began Leverett's official study of the glacial and associated deposits in the United States. In 1890 he became an assistant geologist with the U. S. Geological Survey; he was geologist from 1901 to 1928 and senior geologist from July 1, 1928, to March 1929, when he was retired at the age of 70 years. Dr. Chamberlin continued more or less actively in charge of the glacial studies for the Federal Survey, both while he was president at the University of Wisconsin beginning in 1887 and also after he became head professor

of geology at the University of Chicago in 1892, until the year 1904, when he severed his connections with the U. S. Geological Survey. During all this time the two men were closely associated by correspondence and conferences, during extensive field studies of the glacial and associated deposits. This association continued much the same through the later years until Chamberlin's death on November 15, 1928.

The extent of the area covered by Leverett's field studies and mapping was very notable indeed, and from these studies there came a large number of scientific papers. Several of his more comprehensive publications were issued by the U. S. Geological Survey. In Monograph 38, *The Illinois glacial lobe* (published in 1899), are described the great Illinoian drift sheet and its relation and later glacial deposits. In this work was included the classification of all the glacial and interglacial deposits of the Upper Mississippi Valley, as developed very largely by Chamberlin and Leverett. This, with later modifications, is still the standard classification of North American glacial geology.

From Illinois Leverett's field work was extended eastward over Indiana, southern Michigan, the western part of New York, and the northwest part of Pennsylvania. The results of this study were published in Monograph 41, *Glacial formations and drainage features of the Erie and Ohio Basin*. In this were also shown the relations of the remarkable abandoned beaches bordering the Great Lakes. These were formed when the outlets of the several basins were blocked by oscillating fronts of the great glacial lobes and were deformed by northeasterly differential uplifts as melting removed the weight of the vast accumulations of ice. Frank B. Taylor was for many years associated with Mr. Leverett in the mapping and study of the abandoned beaches, and when the field studies were extended northward over the lower and upper peninsulas of Michigan they became joint authors of Monograph 53, *Pleistocene of Indiana and Michigan and history of the Great Lakes*, published in 1915.

When the mapping was continued north and west through northern Michigan and Wisconsin and into northeastern Minnesota, a shorter work by Leverett, *Moraines and shore lines of the Lake Superior Basin* (Professional Paper 154) was published by the Survey in 1929. Following this Leverett's mapping proceeded throughout Minnesota and into adjacent parts of Iowa and the Dakotas. In this survey Leverett revised the earlier mapping by Warren Upham and delineated on a large map the succession of alternating moraines and glacial outwash plains and the abandoned beaches of Glacial Lake Agassiz. From this work came his Professional Paper 161, *Quaternary geology of Minnesota*, issued by the Federal Survey in 1932. To the preparation of this report contributions were made by F. W. Sardeson, who also assisted in the field mapping. Later Leverett studied the relations along the southern border of the glacial drift through much of the distance between northeastern Kansas and the Atlantic coastline in New Jersey.

Most of the studies were made by Mr. Leverett while on the staff of the U. S. Geological Survey; work on his manuscripts was mostly done at his home, which was for years in Ann Arbor, Mich. At intervals he was released from his regular work to make other investigations, some of these for state geological surveys. In 1908 he went to Europe to make comparative studies on the several drift sheets there and he set up a tentative correlation between the glacial deposits of Europe and the United States in a paper *Comparison of North American and European Glacial Deposits*, published in Zeitschrift für Gletscherkunde 4: 1910.

In 1887 Mr. Leverett married Frances E. Gibson, who died in 1892. In 1895 Dorothy C. Park became his wife and now survives him.

WILLIAM C. ALDEN.

To coordinate the various branches of science, to integrate science as a whole with other lines of human activity, and to quicken an appreciation of science on the part of the general public—these were the impelling interests in the life of JAMES MCKEEN CATTELL[1] (May 25, 1860–January 20, 1944), a member of this Academy. As a young and brilliant psychologist he foresaw more clearly than any of his contemporaries that science, in order to progress, must break away from the cloistered tradition and compartmentalization of the academic laboratories; that in order to be of real benefit to the people it must be attuned

[1] For details of Dr. Cattell's life and activities see Science 99, No. 2565, Feb. 25, 1944, and Who's Who in America.

with human affairs in general; and that in order to gain the necessary support for further development it must gain the confidence of the public at large.

Only in his later years did these objectives become clear to his colleagues. In his earlier years progress was difficult and slow. Every opportunity that appeared was seized and exploited. At first his endeavors were more or less disconnected and haphazard. Quite naturally his interest for some time was centered largely on psychology, though this never obscured his broader vision; later his expanding interests covered all lines of science.

The media through which he worked were the numerous publications that he edited, several of which he himself had founded, and the American Association for the Advancement of Science in which he was a dominant force for 50 years, and which owes its present organization and prestige largely, if not mainly, to his efforts. His influence in stimulating and organizing the scientific spirit of America was much greater than appears on the surface. As editor of various scientific journals he was interested in bringing out facts and in stimulating discussion. He solicited contributions from those whom he thought had something worth while to say, and many significant papers were published in his journals which, except for his stimulation, would never have appeared. Scrupulously fair and honest in his dealings with contributors, he interpreted his duties as editor with unusual liberality, and not infrequently there appeared in his journals papers expressing ideas with which he did not agree.

During the first world war the improvement and extensive use of the airplane and the radio, and other implements and devices, quickened public interest in science. Dr. Cattell was one of a small group who felt that science had now outgrown its orthodox academic confines and had secured the serious attention of an important sector of the lay public. It had therefore become desirable that the general public be kept informed through the press of progress in the various branches of science. Upon the establishment of Science Service in 1921, Dr. Cattell was chosen one of the members of the Board of Trustees, and served continuously upon it until his death, most of the time as a member of the Executive Committee, and for nine years as President.

Coincidentally with the establishment of Science Service the *New York Times* and the *Cleveland Press* each detailed one of their ablest writers as science editor. Their example was soon followed by other newspapers and the large press associations. Although these independent science editors were direct competitors of Science Service, Dr. Cattell showed no favoritism, but assisted and encouraged all serious attempts to report science accurately. When the National Association of Science Writers was organized in April, 1934, the science editors showed their appreciation of his efforts in their behalf by electing him an honorary member.

Personally Dr. Cattell was a man of distinctive and forceful personality, courageous, with strong convictions, intense in an argument—indeed on occasion almost violent. Motivated by the highest principles, and always honest, if he thought, on reflection, that he had done an injustice he sought out his adversary and apologized to him. But basically his was an unusually gentle and kindly nature. He never felt that he really knew anyone unless he knew his whole family, especially the children. And although many of his colleagues stood very much in awe of him, small children took to him at once. He was always very human. In his rare periods of relaxation, for instance when attending parties given by the science writers, he joined enthusiastically in the merrymaking, becoming a boy again.

Dr. Cattell will long be remembered for his personal contributions to the study of psychology and to the improvement of education; but his outstanding contribution was the part he played in the awakening of a feeling of social responsibility on the part of our scientific people, and of an awareness of the importance of science on the part of the general public.

AUSTIN H. CLARK.